QK1
.M593
v.6
1918
copy 1

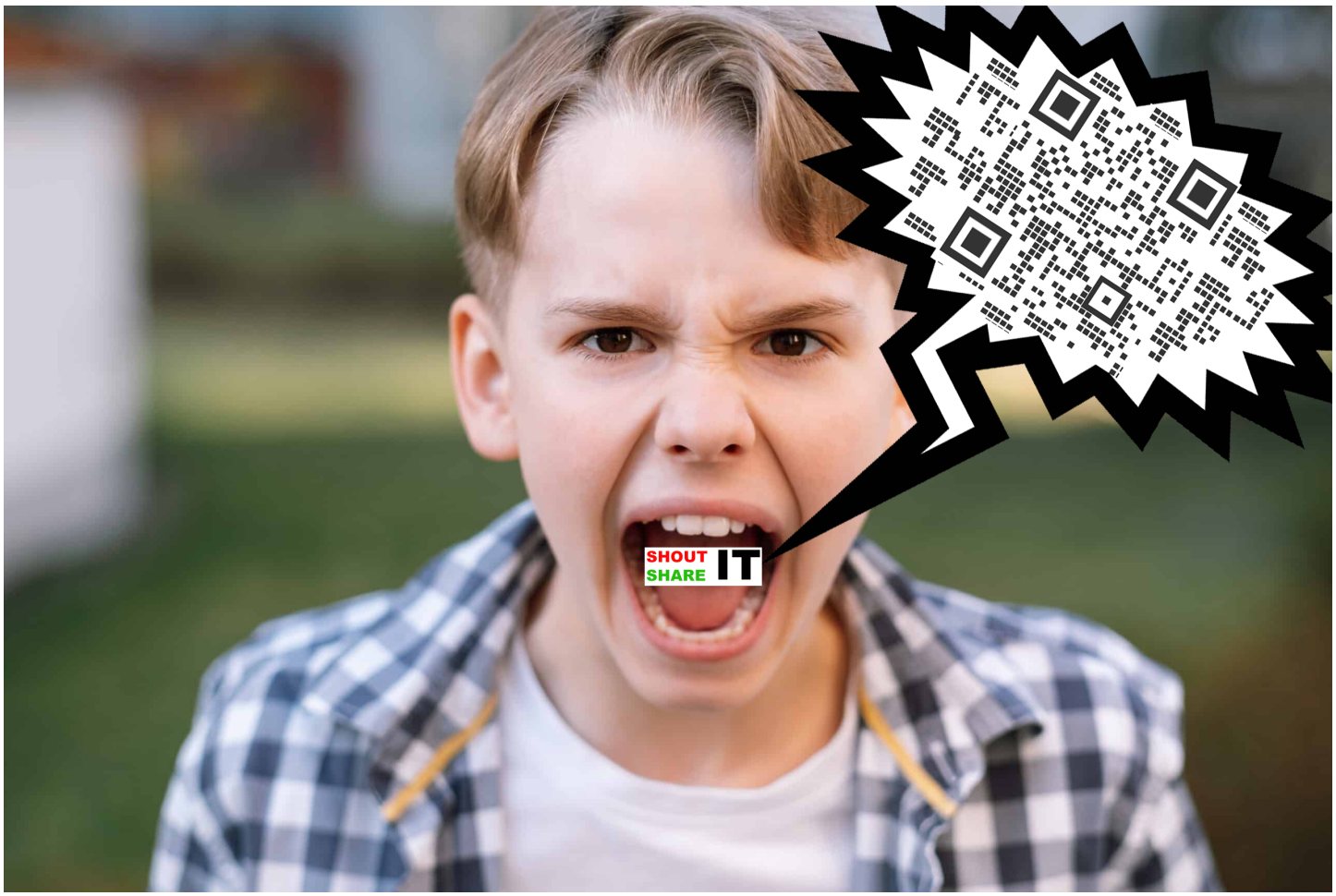
MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME VI
WITH 24 PLATES
1918

ST. LOUIS, MISSOURI
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

MISSOURI BOTANICAL
GARDEN LIBRARY


SHOUT
SHARE IT

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI JANUARY, 1918 No. 1

CONTENTS

	Page
Report of the Officers of the Board - - - -	1
Twenty-ninth Annual Report of the Director - -	3
Statistical Information for December, 1917 - - -	17

ST. LOUIS, MO.
1918
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

***EX-OFFICIO* MEMBERS**

President of The Academy of Science of St. Louis.

HENRY W. KIEL,
Mayor of the City of St. Louis.

FREDERIC A. HALL,
Chancellor of Washington University.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

ROLAND W. SWITZER, Secretary.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., January, 1918 No. 1

REPORT OF THE OFFICERS OF THE BOARD

To the Board of Trustees of the Missouri Botanical Garden:

We submit for your consideration a statement of the financial transactions for the year ending December 31, 1917.

The results during the year have been satisfactory, the vacancies amounting to only $1,845.25, and the income from rentals, royalties, and interest exceeding that of 1916 by $8,192.23. At the present time we have only two vacant buildings, the total rentals of which were $1,320.00 per year.

A one-story brick addition was erected in the rear of the stores, Nos. 816-18 North Grand Avenue, at a cost of $1,848.82, increasing the rental $420.00 per annum. During the year a new building was erected at the southeast corner of Seventh Street and Washington Avenue, at a cost to the lessee of $75,000.00, and the lease extended for a term of ten years from March, 1929.

The tract of land west of Tower Grove Avenue, known as Shaw's Vandeventer Avenue Addition, has been improved, with the exception of that portion west of Newstead Avenue, which contains about 2,100 front feet. This improvement will embrace the making of Alfred Avenue, a street about 450 feet long and 50 feet wide, a sewer system for blocks 4 and 5, and some 435 feet of sidewalk on the south side of Lafayette Avenue, the total cost approximating $7,000.00.

Sales of residence property during the year were as follows:

Lafayette Avenue Addition . .	1,220 front feet .	$40,010 00
Arsenal Street Addition . . .	105 front feet .	4,065 00
Vandeventer Avenue Addition .	1,152 front feet .	36,000 00
		$80,075 00

A new residence was erected at the Garden for the use of the engineer, at a cost of $4,087.03, and general improvements were made in the Garden, costing $13,759.62.

Three of the bequests provided for in Mr. Shaw's will have been carried out—the annual Flower Sermon, the appropriation for the St. Louis Flower Show, and the Gardeners' Banquet.

For an itemized account of receipts and disbursements your attention is called to the following statement:

INCOME:

Rentals		$162,691 65
Interest and dividends		17,893 10
Royalties received		9,448 30
Total income		$190,033 05

LESS — ADMINISTRATION AND UPKEEP EXPENSES:

Commissions on bonds	$ 967 50	
Heating and janitor service	807 09	
Insurance	5,597 51	
Interest paid	547 50	
Legal expenses	1,086 65	
Miscellaneous expenses	1,698 94	
Office salaries and expenses	5,260 52	
Repairs	6,465 78	
Water license	635 64	
Taxes	37,170 81	60,237 94
		$129,795 11

LESS — ANNUAL BEQUESTS:

Annual Flower Sermon, Gardeners' Banquet and Trustees' Banquet	1,600 00
Amount available for upkeep of Garden	$128,195 11

DISBURSED AS FOLLOWS:

Garden account	$58,381 05	
Herbarium	7,153 99	
Library	4,813 02	
Research and instruction	15,487 15	
Garden office	10,931 13	96,766 34
		$31,428 77
LESS—GARDEN IMPROVEMENTS		19,922 55
Excess income over expenditures for the year ending December 31, 1917		$11,506 22

Respectfully submitted,

EDWARDS WHITAKER, President.

Attest:

R. W. SWITZER, Secretary.

TWENTY-NINTH ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the twenty-ninth annual report of the Director.

Perhaps the improvement of greatest importance at the Garden during 1917 has been the reconstruction of the Garden between the main gate and the palm house, with the accompanying rearrangement of the water gardens here, they now being in the form of permanent concrete pools of dignified design. This very necessary improvement has necessitated a great amount of grading, the removal of over 1,500 cubic yards of soil, the removal of old and construction of new and more direct walks, the laying of new drains, etc. A number of large trees have been transplanted to this area, including two ginkgos, several liquidambars, and thirty fine specimens of *Magnolia grandiflora,* as well as many small junipers and other conifers, and a hedge of barberry, extending from the main gate to the palm house.

As a part of this general scheme, a new rose garden has been established to the south of the Linnean house, on the site formerly occupied by the old greenhouses, removed in 1916. Practically all the plants from the old rose garden near the administration building have been transferred to this new location, and a great many new varieties added, as well as additional roses which have been proved to be hardy in St. Louis. The new location will undoubtedly make this—one of the most popular attractions at the Garden—much more accessible to the public. The garden has been enclosed with a planting of several hundred hawthorns, which will materially add to its beauty in both spring and fall. All of this has undoubtedly been well worth while, since the incorrectness of the grade has been an eyesore to all observers, and the dignity of the new formal approach to the conservatories impresses the visitor at once on entering the main gate.

Work begun on the economic garden in 1916 has been continued throughout the year. A walk and flight of steps from the economic house to this garden have been built, four pools have been completed, and permanent planting installed, including a collection of shrubs, sample grass plots, cordon fruit trees, and birches for pleached alleys.

During the summer plots of farm crops of all sorts were shown, as well as collections of flowering plants, vines, etc. This garden as a whole is now taking on a finished appearance and is proving extremely valuable as a demonstration of what may be grown in the vicinity of St. Louis.

Many improvements have been made in other parts of the Garden, the two most notable being the construction of a house for the engineer and the building of a pit for the storage of coal. The engineer's house, completed in November, is a six-room brick structure, with all modern conveniences. A great amount of filling was necessary to bring this site up to grade, but the house, while facing Shaw Avenue at the west end of the stone wall, is very near to the boiler house, thus adding both to the convenience of the engineer and safety of the Garden. A new water connection was brought in from Shaw Avenue to supply this house, as well as to provide much-needed additional water for the propagating houses. A storage pit with a capacity of 25 to 30 cars of coal has been practically completed during the year. The construction of this pit has been a slow process, since it is all of reinforced concrete and was built in sections.

Much time has been devoted to the building of new walks where they seemed desirable. The main conservatories have been painted both outside and inside, and the stone wall on Shaw Avenue has been pointed. In the fern house a new concrete bridge with porous rock trim has been built, replacing the rustic bridge, which had become unsafe. The interiors of the new shops and other service buildings have been completed, involving the construction of benches, lockers, racks, and necessary fittings in paint and glass storage houses.

Articles in the February, April, and May BULLETINS on back-yard gardens and window boxes, vegetable gardens, canning, drying, and storage of vegetables, created an unprecedented demand for these numbers. Over 40,000 copies of the February number alone have been reprinted and distributed by the St. Louis Art League and the National Clean-Up Association, while articles from the April and May issues were widely copied by other publications throughout the country. In addition to this means of assisting the public, members of the staff and the garden pupils devoted much time, during the summer, to superintending school vegetable gardens and those promoted by the Food Conservation Committee, as well as answering many calls for information along these lines, by mail and telephone.

Opportunity was given early in the spring to employes of the Garden to raise vegetables for their personal use on plots

prepared by the Garden. Garden tools were also loaned for this purpose, and many were glad to avail themselves of this assistance, who otherwise would have been unable to have had a vegetable garden. Unusual quantities of corn, oats, millet, alfalfa, soy beans, cow-peas, and cane were grown during the summer. Over 500 bushels of corn were harvested and sufficient hay to more than supply our stock for the coming year. A new roof was built on the walls of the old hay barn to provide storage room for the large crop.

The floral displays have been maintained throughout the year in their usual excellence. These shows continue to attract more and more attention from local commercial growers and florists, since the Garden is able to show many novelties before they are on the open market. March 15-18 the St. Louis Florists' Club held a flower show in the Coliseum, which was the most successful thing of its kind attempted in St. Louis in several years. The Shaw medal was offered by the Garden as well as $500 dollars in premiums. Nineteen first prizes were obtained by the Garden in addition to the silver medal offered by the Society of American Florists and Ornamental Horticulturists.

The use of the Garden has been offered to the Government in whatever capacity seems most fit, together with the equipment of the laboratories, sterilizing apparatus, etc. The Garden has also been of considerable assistance to the Missouri Library Commission, in the collection of books and magazines to be forwarded to the army cantonments. Information furnished by the Garden to meet the demand arising through the shortage of certain drugs, fibers, dyes, etc., due to the war, has even exceeded the amount given out in 1916.

ATTENDANCE FOR THE YEAR 1917

	Week-days	Sundays
January	3,887	2,913
February	3,885	3,095
March	6,205	5,984
April	9,624	13,794
May	17,943	10,332
June	9,128	19,003
July	10,860	7,570
August	14,508	9,729
September	12,211	14,432
October	11,133	15,272
November	38,744	29,751
December	5,470	3,981
	143,598	135,856
		143,598
TOTAL		279,454

ANNUAL BEQUESTS

The Flower Sermon, provided for in the will of Mr. Shaw, was preached in Christ Church Cathedral by the Rev. James E. Freeman, of St. Mark's Church, Minneapolis, Minnesota, on May 13, 1917.

The Twenty-eighth Gardeners' Banquet was held on the evening of September 12, 1917, at the Mercantile Club, members of the American Association of Park Superintendents, then meeting in St. Louis, being guests of the evening.

SCHOOL FOR GARDENING

Through graduation and the call to arms by the Government, the attendance of the School for Gardening has decreased. Miss Clara Fuhr, Mr. Clarence Pedlow, Mr. P. A. Kohl and Mr. A. J. Cella completed their course in September and were awarded the Garden certificate. Miss Fuhr is employed temporarily at the Bourdet Floral Company; Mr. Pedlow is a draftsman and outdoor foreman for Mr. C. W. Fullgraff, landscape architect; Mr. Kohl has been appointed Assistant Supervisor of School Gardens in St. Louis; Mr. Cella is in charge of the landscape department of Stark Nursery Company, at St. Louis.

Three of the students have entered the army service. Mr. James Monteith is corporal of Headquarters Company of 128th Field Artillery, now at Camp Doniphan; Mr. George Pedlow is a marine stationed "somewhere" in France; Mr. W. G. Ellis is corporal of Battery C, 345th Field Artillery, Camp Travis.

Due to the resignation of Mr. W. W. Ohlweiler, several of the courses given by him were taken over by other members of the instruction staff, the course in soils and fertilizers being given by Mr. C. L. Moody.

During the spring and summer campaign for thrift gardens, the students aided the Women's Food Conservation Committee in the work of organization. At the same time Miss Clara Fuhr was engaged by the Webster Groves Garden Club to take charge of school gardens in that town and achieved very favorable results.

As a result of competitive examinations, Miss Anne L. Chase of St. Louis, Mr. R. D. Mitchell of Gotha, Florida, and Mr. F. C. Harris of Coffeen, Illinois, were appointed to the vacant scholarships. Miss Virginia McMath of Webster Groves is also enrolled in the regular course.

A course of eight lectures on "The Development of a Small Place" has been arranged for the benefit of amateur gardeners, and treats in detail the various theoretical and practical phases of designing, developing and maintaining a small estate. Several women have been enrolled by the payment of a nominal tuition fee.

RESEARCH AND INSTRUCTION

Graduate instruction in botany offered in connection with the Shaw School of Botany of Washington University, and conducted in the graduate laboratories of the Garden, reached a maximum during the latter part of 1916-17. The operation of the federal draft and the great demand for men in the research and instructional departments of the agricultural colleges and experiment stations have together reduced materially the enrollment in graduate work for 1917-18. This has made it desirable and necessary to depart somewhat from the announced program of courses of instruction. At the same time it has given members of the staff greater opportunity to devote themselves to other phases of the work made more urgent by the conditions. Coöperating with the departments of Washington University, the facilities of the laboratories have been offered for the solution of problems confronting business firms in the city and vicinity, directly or indirectly engaged in the manufacture of war products. Much interest has been manifested in this opportunity. In addition, the members of the scientific staff, as well as those of the Garden staff, have given considerable attention to the work of increased production and of conservation of vegetable products. This has required an increased number of lectures, conferences, personal inspection of fields and gardens, and much correspondence.

Scientific and Extension Lectures.—The following are the more important given by members of the scientific and Garden staffs during 1917:

Alexander Lurie, January 19, before the Mothers' Club of the Benton School, "Outdoor Flowers."

George T. Moore, February 1, before the Phi Gamma Delta Fraternity, "The Garden and the Town."

George T. Moore, February 7, before the Wednesday Club, "New Fruits and Vegetables for the St. Louis Market."

George H. Pring, February 13, before the St. Louis Aquarium Society, "Native Aquatic Plants Adapted to Aquaria."

Alexander Lurie, February 16, before the Mothers' Club of the Devonshire School, "Back-yard Gardens."

Alexander Lurie, March 13, before the Webster Groves Garden Club, "Hot-beds."

B. M. Duggar, March 16, before the Alumni Association of the Washington University Dental School, "Some Phases of Parasitism and Immunity in Plants."

Alexander Lurie, March 16, before the St. Louis Flower Show, "Back-yard Gardens."

George H. Pring, March 16, before the St. Louis Flower Show, "Aquatic Plants for St. Louis."

George T. Moore, March 27, before the Washington University Association, "Some New and Old Plant Industries."

B. M. Duggar, April 7, before the Washington University Chapter of Sigma Xi, "Some Materials and Problems in Plant Pathology."

Alexander Lurie, April 10, before Butler Bros.' Employes' Association, "Vegetables."

Alexander Lurie, April 10, before Richmond Heights School Patrons' Association, "Vegetables."

W. W. Ohlweiler, April 19, before the Boy Scouts, at Knights of Columbus Hall, "Vegetable Gardening."

P. A. Kohl, April 20, before the Boy Scouts, at St. Peter's Evangelical Church, "Vegetable Gardening."

Alexander Lurie, April 20, before the Boy Scouts, at Bryan Mullanphy School, "Vegetable Gardening."

Alexander Lurie, April 20, before the Rose Fanning School, "Flower Gardens."

Clarence Pedlow, April 20, before the Boy Scouts, at Kingshighway Presbyterian Church, "Vegetable Gardening."

George H. Pring, April 20, before the Boy Scouts, at St. Peter's Episcopal Church, "Vegetable Gardening."

J. M. Greenman, April 23, Public Lecture Course of Washington University, "The Flora of the High Rockies."

B. M. Duggar, April 30, Public Lecture Course of Washington University, "The Plant Life of the Desert."

Alexander Lurie, May 4, at the Kirkwood City Hall, "Questions on Vegetables."

George T. Moore, May 4, at the Kirkwood City Hall, "Vegetables."

George T. Moore, May 10, before the McKinley High School, "Some Applied Aspects of Botany."

Alexander Lurie, May 14, at Webster Groves, "Questions on Vegetables."

George T. Moore, May 16, before the St. Louis College of Pharmacy, at Sheldon Memorial, valedictory address.

George H. Pring, June, before the St. Louis Association of Gardeners, "Development of Hybrid Nymphaeas."

Alexander Lurie, October 26, before the Household Science Club of Belleville, at the Carnegie Library, "The Storage of Vegetables."

Hermann von Schrenk, November 13, before the Kirkwood Monday Evening Club, "My Summer in the Garden."

George H. Pring, November 22, before the St. Louis Gardeners' Association, "The Botanic Gardens, Kew, England."

George T. Moore, November 26, Public Lecture Course of Washington University, "The Evolutionary Consequences of the War."

George H. Pring, December 6, before convention of National Gardeners' Association, Chicago, "The Botanic Gardens, Kew, England."

George H. Pring, December 12, before convention of Missouri Horticultural Society, Kansas City, "Aquatic Gardens."

Graduates, Fellows and Investigators.—During the season of 1916-17 there were registered for graduate work sixteen students, as follows: Ruth Beattie, instructor in botany, Wellesley College; W. W. Bonns, Rufus J. Lackland Research Fellow; C. W. Dodge, Lackland Research Fellow; Lucy D. Foote, teacher, St. Louis Public Schools; G. W. Freiberg, formerly research assistant; I. C. Hoffman, industrial fellow, Purdue University; H. M. Jennison, assistant in botany, Washington University; A. Lurie, horticulturist, Missouri Botanical Garden; D. C. Neal, Lackland Research Fellow; Alice Pickel; L. J. Pessin, Lackland Research Fellow; W. S. Reeves, scientific assistant to the Director; H. Schmitz, Lackland Research Fellow; J. W. Severy, teaching fellow, Washington University; R. A. Studhalter, assistant bacteriologist, Montana Agricultural Experiment Station; S. M. Zeller, special research assistant, Yellow Pine Association. Owing to the operations of the draft, to voluntary enlistment in public service, and to the great demand for scientific men in botanical and agricultural work, the number of students has been reduced for the season of 1917-18, and the following are registered for regular graduate work: W. W. Bonns, Anne W. Davis, C. W. Dodge, Lucy D. Foote, H. M. Jennison and E. B. Payson. In addition, the following visiting investigators have been in residence, using the facilities of the graduate laboratory, namely, Dr. E. R. Allen and Dr. S. M. Zeller.

Appointments to the Rufus J. Lackland fellowships for 1917-18 were made prior to the entrance of the United States into the war, with the following result: W. W. Bonns, S. B. Massachusetts Institute of Technology, 1899, B. S. A. Cornell University, 1909, reappointed third year; W. H. Cham-

bers, B. S. University of Illinois, 1915; C. W. Dodge, A. B. Middlebury College, 1915, reappointed third year; D. C. Neal, B. S. Mississippi Agricultural and Mechanical College, 1909, A. M. Washington University, 1916, reappointed second year; H. Schmitz, B. S., 1915, and M. S., 1916, University of Washington, reappointed second year.

Other appointments included that of Anne W. Davis, A. B. Bryn Mawr, 1917, research assistant, to succeed Dr. G. W. Freiberg; of J. W. Severy, A. B. Oberlin College, 1915, and E. B. Payson, B. A. University of Wyoming, 1917, teaching fellows in Washington University; and of W. S. Reeves, B. S. Pomona College, 1915, scientific assistant to the Director.

Graduates formerly connected with the laboratory and terminating their connection during the calendar year for educational or scientific work are as follows: Dr. G. W. Freiberg, Messrs. W. S. Reeves and J. W. Severy, now in the Washington University Base Hospital, Unit 21, France; I. C. Hoffman, assistant horticulturist, Bureau of Plant Industry and Purdue Experiment Station; H. M. Jennison, assistant professor of botany, Montana Agricultural College; D. C. Neal, pathologist, citrus investigations, United States Department of Agriculture, Alabama Experiment Station; H. Schmitz, Naval Reserves; R. A. Studhalter, forest pathologist, United States Department of Agriculture; S. M. Zeller, investigator, Yellow Pine Association, stationed at the Missouri Botanical Garden.

Mr. W. H. Chambers was unable to report for a fellowship and is now enlisted in the Sanitary Corps of the United States Army.

Dr. E. R. Allen, associate in the Ohio Agricultural Experiment Station, in charge of the department of soils and of soil chemistry, has been granted a leave of absence for the academic year by the station to pursue investigations in the graduate laboratory. He has also been appointed associate in biological chemistry in the Washington University Medical School.

At the commencement of Washington University, June 14, degrees were conferred on the members of the graduate laboratory as follows: Doctor of Philosophy, G. W. Freiberg, with a thesis on "Studies in the mosaic diseases of plants," and S. M. Zeller, thesis, "Lenzites saepiaria Fries, with special reference to enzyme activity." The degree of Master of Arts was conferred on three students as follows: Ruth Beattie, thesis, "Temperature relations of enzymes, with special refer-

ence to the effects of various temperatures upon the formation of glucose from starch by the action of diastase"; Alice Pickel, thesis, "A taxonomic study of the genus Tetradymia"; and R. A. Studhalter, thesis, "The factors involved in the dissemination of the chestnut bark disease."

Publications and Papers.—There are given below a list of the more important papers published during the year as a result of investigations and observations made in the laboratories, herbarium and Garden. This list does not include many briefer popular discussions, articles which have appeared in the BULLETIN, and abstracts in scientific journals.

Bryan, Mary M. "A Spurless Variety of Habenaria psycodes." Ann. Mo. Bot. Gard., 1917.

Burt, E. A. "Merulius in North America." Ann. Mo. Bot. Gard., 1917.

Burt, E. A. "Odontia Sacchari and O. saccharicola, New Species on Sugar Cane." Ann. Mo. Bot. Gard., 1917.

Burt, E. A. "The Thelephoraceae of North America. VIII." Ann. Mo. Bot. Gard., 1917.

Duggar, B. M., Severy, J. W., and Schmitz, H. "Studies in the Physiology of the Fungi. IV. The Growth of Certain Fungi in Plant Decoctions." Ann. Mo. Bot. Gard, 1917.

Duggar, B. M., Severy, J. W., and Schmitz, H. "Studies in the Physiology of the Fungi. V. The Growth of Certain Fungi in Plant Decoctions." Ann. Mo. Bot. Gard., 1917.

Duggar, B. M. "Botany." American Year Book, 1916.

Freiberg, G. W. "Studies in the Mosaic Diseases of Plants." Ann. Mo. Bot. Gard., 1917.

Gates, R. R. "A Systematic Study of the Genus Trillium, Its Variability and Its Relation to Paris and Medeola." Ann. Mo. Bot. Gard., 1917.

Greenman, J. M. "Monograph of the North and Central American Species of the Genus Senecio—Part II." Ann. Mo. Bot. Gard., 1917.

Greenman, J. M. "Two Exotic Compositae in North America." Ann. Mo. Bot. Gard., 1917.

Moore, G. T. "Algological Notes. I. Chlorochytrium gloeophilum Bohlin." Ann. Mo. Bot. Gard., 1917.

Moore, G. T. "Algological Notes. II. Preliminary List of Algae in Devils Lake, North Dakota." Ann. Mo. Bot. Gard., 1917.

Noyes, J., and Duggar, B. M. "Gardens of St. Louis." Art League Bull., 1917.

Pring, G. H. "Hybrid Nymphaeas." Ann. Mo. Bot. Gard., 1917.

Zeller, S. M. "Studies in the Physiology of the Fungi. III. Physical Properties of Wood in Relation to Decay In-

duced by Lenzites saepiaria Fries." Ann. Mo. Bot. Gard., 1917.

The following papers were presented before the Botanical Society of America during convocation week of the American Association for the Advancement of Science, at Pittsburgh, December 28 to January 1:

B. M. Duggar and Anne W. Davis. "The Disinfection of Seed for Pure Culture Work."

B. M. Duggar and C. W. Dodge. "The Use of the Colorimeter in Hydrogen-Ion Determinations of Culture Solutions and Plant Juices by the Indicator Method."

George T. Moore. "The Subterranean Algal Flora."

George T. Moore. "A Wood Penetrating Alga."

S. M. Zeller and C. W. Dodge. "Rhizopogon in North America."

HERBARIUM

Continued progress has been made in the herbarium during the year. A relatively large amount of new material has been acquired; and another room on the third floor of the office building has been equipped with the much-needed steel cases, which give sufficient capacity to accommodate all of the gymnosperms, including the valuable collections of Coniferae from the Engelmann herbarium.

New Accessions.—The private herbarium of Mr. John H. Kellogg, consisting of upwards of 12,000 specimens, has been acquired by purchase. This collection consists primarily of plants from Missouri, Arkansas and Texas, but also contains several sets of plants from various parts of the United States, which were obtained by Mr.Kellogg through exchange with correspondents. Among other important accessions secured during the year are the following: From Dr. Adolf Alt, 65 plants of Switzerland; E. Bartholomew, 300 "Fungi Columbiani," and 100 "North American Uredinales"; Bernice Pauahi Bishop Museum, 420 plants of the Hawaiian Islands; Miss Florence Beckwith, 87 plants of Missouri, Illinois and Kansas; Dr. R. P. Burke, 266 specimens of fungi of Alabama; B. F. Bush, 213 plants of Missouri; California Academy of Science, 398 plants of the Galapagos Islands, and 74 plants of California; Canton Christian College, 835 plants of southern China; F. S. Collins, 100 "Phycotheca Boreali-Americana"; Ira W. Clokey, 1,205 plants of Colorado, Texas, Utah, Nevada, Mexico, etc.; Prof. C. Conzatti, 70 plants of Mexico; D. L. Crawford, 217 plants of California; Rev. John Davis, 1,164 plants, chiefly from Missouri and South Carolina; J. A. Drushel, 107 plants, mainly

from Missouri; Dulau & Co., 660 specimens of Gottsche and Rabenhorst's "Hepaticae Europaeae"; Dr. W. G. Farlow, 461 specimens of algae, lichens and fungi; Mrs. R. S. Ferris, 112 plants of California; Field Museum of Natural History, 731 plants of central and western United States; G. W. Freiberg, 573 plants of Washington; Gray Herbarium of Harvard University, 915 plants, chiefly from Newfoundland, eastern and southern United States; Dr. Homer D. House, 204 specimens of Thelephoraceae and other fungi of New York; E. L. Johnston, 105 plants of Colorado; P. Jörgensen, 342 plants of the Argentine Republic; Dr. W. H. Long, 94 timber-destroying fungi; Dr. C. F. Millspaugh, 143 plants of Yucatan; Prof. Aven Nelson, 420 plants of Alaska and 907 plants of Idaho; New York Botanical Garden, 1,196 specimens from various parts of North America, Bermuda and the West Indies; Dr. L. O. Overholts, 107 specimens of fungi of Colorado and Pennsylvania; Edwin B. Payson, 451 plants, mainly from Colorado and Wyoming; Philadelphia Academy of Natural Sciences, 451 plants of Delaware; Dr. H. von Schrenk, 253 specimens, chiefly from the herbarium of Prof. Joseph Schrenk; P. C. Standley, 95 plants of Florida; Dr. Forrest Shreve, Compositae and Euphorbiaceae from Arizona; J. A. Stevenson, 57 specimens of fungi from Porto Rico; H. Sudre, 50 specimens of Rubus and 50 specimens of Hieracium from France; United States National Museum, 469 plants from various parts of North America and 375 plants from the Canary Islands; University of Texas, 126 plants of Texas; Charles T. Vorhies, 117 plants from northern Arizona; Dr. S. M. Zeller, 475 plants of Washington. A complete list of accessions received each month of the year has been recorded in the successive issues of the BULLETIN.

Mounting and Distribution.—The mounting of herbarium specimens has continued throughout the greater part of the year, and a large part of the material received on new accessions has been mounted and inserted in the organized herbarium. Several thousand miscellaneous undetermined specimens, accumulated during previous years, have been identified and distributed. In addition to this, nearly 1,500 specimens from the private herbarium of Dr. A. W. Chapman, which was purchased several years ago, have been mounted and incorporated in the general collection.

Field Work.—The botanical survey of the southwest in coöperation with the Arnold Arboretum of Harvard University has been pursued throughout the entire season, except for the last two weeks in August; and the collector, Mr. Ernest J. Palmer, has visited numerous localities in Texas,

Oklahoma and Arkansas. Spring and summer collections were made on an itinerary beginning early in March, continuing until early August, and embracing the following stations which were visited essentially in the order enumerated: Corpus Christi, Campbelton, Alice, Laredo, Cotulla, Uvalde, Pulliam, Del Rio, Devils River, Alpine, San Angelo, Brownwood, Houston, Dayton, Livingston, Boerne, Kerrville, Sabinal, Utopia, Concan, San Marcos, Blanco, Boerne, San Antonio, Sullivan, Kingsbury, Milano, Somerville, Quarry, College Station, Bryan, Valley Junction, Milano, San Saba, Brady, Menard, Brownwood, Houston, Morgans Point, Goose Creek, Dayton, Livingston, Huntsville, Latexo, Grapeland, Palestine, San Marcos, Manchaca, Buda, Blanco, Fisher's Store, Lacey's Ranch, Boerne, Medina Lake, Uvalde, Pulliam, Montell, Barksdale, Del Rio, Devils River, Brownwood, San Angelo, Mertzon, Sweetwater, Blackwell, Fort Chadburn, Big Spring, Lubbock, Amarillo, and Canyon, in Texas; Clinton, Elk City, Snyder, Cache, Anadarko, Lawton, Ryan, and Ringold, in Oklahoma; Denison, in Texas; Mena, in Arkansas; Page, in Oklahoma, and Allenton, in Missouri.

About two weeks in midsummer Mr. Palmer spent in sorting and labeling the plants secured during the early part of the season. On September 1, collecting was resumed at Fulton and McNab, Arkansas, and continued at San Augustine, Beaumont, Fletcher, Houston, Liberty, Dayton, Livingston, Palestine, Latexo, Grapeland, Blanco, San Marcos, Boerne, San Antonio, Pleasanton, Coraleta, Sabinal, Utopia, Comstock, Del Rio, Uvalde, Montell, Brownwood, Sweetwater, Big Spring, in Texas, and at Altus, Elk City, Snyder, and Muskogee, in Oklahoma. Thus a splendid representation of both the vernal and autumnal flora was obtained.

Although the season on the whole was an exceptionally dry one and collecting therefore more difficult than in the three years preceding, yet upwards of 10,000 specimens were obtained. These collections afford excellent material for scientific study, especially in tracing the geographical range of species and in throwing more light on many species about which very little at present is known. Seeds of a number of plants were secured, particularly of such plants as seem of special interest for growing in the garden.

Distribution of Duplicates.—A relatively small number of duplicate herbarium specimens has been distributed to correspondents during the year. However, 2,572 specimens have been forwarded chiefly to American institutions on the basis of exchange; and in return therefor several valuable series of plants have been received.

Use of Herbarium by Outside Botanists.—Visiting botanists from different parts of the country have consulted the herbarium from time to time during the year. Several loans of herbarium specimens have been made to institutions in order to facilitate the work of specialists in monographing technical groups of plants, and in studying the detailed flora of different parts of the country. Such loans for the most part have been of mutual advantage. An important work has been undertaken by Dr. Norma E. Pfeiffer of the University of North Dakota, who spent the month of July in the herbarium in pursuance of a monographic study of Isoetes.

Statistical Summary: (For the year ending December 31, 1916).

Number of specimens acquired on new accessions:

By purchase	19,070	
By gift	5,556	
By exchange	3,489	
By field work	8,537	
Total	36,652	valued at $3,665 20

Number of specimens mounted and incorporated:

From Chapman Herbarium	1,485	
From all other sources	15,860	
Total	17,345	valued at $3,469 00

Number of specimens discarded from the herbarium	136		
Number of specimens sent to correspondents on the basis of exchange	2,582		
Number of specimens in organized herbarium	820,772	valued at	$123,983 05
Number of specimens in unorganized herbarium (estimated at)	62,000	valued at	5,080 00
Wood specimens, etc., supplementing the herbarium		valued at	280 00
Microscope slides, etc		valued at	410 00
Total valuation			$129,753 05

LIBRARY

Since the Garden library receives annually 944 serial publications containing more or less botanical matter, a large part of the daily work is required for checking up and entering the current numbers of these publications as they arrive, sending them on the round of the laboratories, collating the volumes for the binder and finally indexing and distributing them on the shelves.

There have been even fewer opportunities than in former years during the war to purchase books which will complete sets in old serials lacking one or more volumes.

Reclassification of Books.—Work has been continued during the year in making changes in the card catalogue and in accession slips in the vault, which were made necessary by reclassification in 1915 of the books and pamphlets in the sections of plant physiology and plant pathology, but this work is not yet completed. About 1,000 more subject cards were prepared during the year to complete the entries in the library section of mycology for the subject card index.

Publications.—The current volume of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, which is our principal exchange for publications of scientific institutions and societies, contains 368 pages, 22 plates and 74 text figures, and consists of the results of botanical researches by individuals connected with the Garden. It is computed that the value per year of exchanges received for the ANNALS is about $1,500. Some exchanges are also received for the BULLETIN. Both the ANNALS and the BULLETIN are supplied to regular subscribers, and separates of the various articles in the ANNALS are for sale by the library. The cash receipts from subscriptions and separates for the year were $502.85.

Loans of Books.—While the library is not a circulating library, it does loan many books which are needed by investigators in other institutions. The borrower makes application for the loan through the library of his home university, which is responsible for return of the book at expiration of the loan and payment of transportation both ways. Loans of 80 books to 29 institutions have been made during the year.

Subject Index.—Work on the subject index of titles of botanical articles published by scientific societies of the world was continued during the greater part of the year. Indexing the serial publications of Great Britain and Ireland and nearly half of those of Germany and Austria had been completed by the end of 1916. During the present year cards have been prepared for botanical articles of nearly all the remaining scientific societies of Germany and Austria, but most of the cards of the present year have not yet been classified by the librarian. In all, about 18,300 articles are now indexed for 179 sets of publications.

Statistical.—There have been 499 volumes, valued at $940.55, and 697 pamphlets, valued at $149.00, donated to the library; and 337 volumes, valued at $957.94, and 18 pamphlets, valued at $19.39, purchased. The library now

contains 35,364 books and 45,712 pamphlets, a total of 81,076, valued at $121,380.51. There are also 326 manuscripts, valued at $1,603.25, 920,929 index cards, valued at $9,281.85, and 162 maps, valued at $258.60, making the total estimated value of the library and card catalogue $132,524.21. A total of 33,584 index cards have been added, of which 19,831 were typewritten by Garden employees, and 13,753 purchased at a cost of $181.76. The number of books bound was 201, and 5 maps were donated, valued at $2.00.

STATISTICAL INFORMATION FOR DECEMBER, 1917

GARDEN ATTENDANCE:

Total number of visitors	9,451

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts	6

LIBRARY ACCESSIONS:

Total number of books bought	8
Total number of books and pamphlets donated	140

HERBARIUM ACCESSIONS:

By Purchase—

Canton Christian College—Plants of southern China	105
Paul C. Standley—Plants of Florida, collected by Miss Jeanette P. Standley	95

By Gift—

Dr. R. P. Burke—Fungi of Montgomery Co., Alabama	70
J. A. Drushel—Plants of Ohio, Missouri, Texas, and Colorado	17
Miss Caroline C. Haynes—Hepaticae of New York and New Jersey	20
New York Botanical Garden—Thelephoraceae from various localities	700
Dr. L. O. Overholts—*Stereum rameale* from Maryland	1
Edwin B. Payson—Plants of Colorado, Wyoming, Idaho, and California	451
C. V. Piper—*Exobasidium Vaccinii* on *Xolisma ferruginea* from Florida	1
Dr. Mary S. Young—*Symphoricarpos sp.* from Texas	1

By Exchange—

California Academy of Sciences—Plants, chiefly from California	75
Ira W. Clokey—Plants of Colorado, mostly *Senecio*	30
Field Museum of Natural History—Plants of Indiana, Illinois, Oregon, etc	731

By Field Work—

Ernest J. Palmer—Plants of Texas, Oklahoma, Arkansas, and Missouri (estimated at)	8,500
	10,797

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director,

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

ANNE W. DAVIS,
Research Assistant.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUCHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI FEBRUARY, 1918 No. 2

CONTENTS

	Page
The Peony	19
Quinine	25
Notes	26
Statistical Information	28

ST. LOUIS, MO.
1918
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL,
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

ROLAND W. SWITZER, Secretary.

PAEONIA OFFICINALIS.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., February, 1918 No. 2

THE PEONY

Although the peony is one of the commonest of our garden flowers, frequently seen growing in single clumps in front or back yards, yet it deserves even greater appreciation. The old-time red "piney," while of great beauty, is dwarfed into insignificance by the gorgeous new forms and colors produced by hybridization in recent times. With its masses of bloom surpassing in effect even the rose, its fragrance, ease of culture, extreme hardiness and permanency, together with comparative freedom from disease and insect attacks, and its adaptability to pleasing landscape effects and cut-flower purposes, the peony stands a peer among flowers. This fitting tribute was paid the peony as early as 1879 by H. Huftelen in Vick's Magazine: "No flowering plants capable of enduring our northern winters are more satisfactory than the peonies. Massive without being coarse, fragrant without being pungent, grand without being gaudy, various in form and color, beyond the possibility of being successfully superseded, they stand in the first rank of hardy flowers."

In America the first mention of peonies was made about 1800, but it was not until the middle of the nineteenth century that the popularity of the plant with its ever-increasing number of varieties began to be apparent. During the latter half of that century the production of such a large number of varieties occurred as to occasion confusion in nomenclature. This difficulty was finally eliminated, however, by the establishment of test gardens at Cornell University, for which upwards of 2,500 different varieties were secured from various nurseries in the United States and abroad. After a period of several years of painstaking effort, the varieties were simmered down to 500 which were clearly distinct. Most of these were derived from *P. albiflora.*

The American Peony Society, as well as some of the local organizations and many enthusiastic individuals, has con-

tributed a great deal to the present enviable position of the peony. The gradual evolution into the highly colored, fragrant, double flower of to-day has come about through the natural tendency towards variation aided by the change of climate, environment, and ease of hybridization.

Because of the extensive variation the peony flowers have been classified into seven types — single, Japanese, anemone, semi-double, crown, bomb, and rose. (1) Single peonies are composed of a ring of broad guard petals surrounding a mass of stamens and carpels. (2) The Japanese type shows the first indication of doubling. The filaments of the stamens have broadened, while the guard petals have remained the same. (3) The anemone presents the next development in doubling. The filaments have been converted into narrow petals, the anthers disappearing completely. (4) The semi-double is not really a step in advance of the anemone, as a few stamens still remain, though those which have changed into petals have begun to resemble the guard petals very strongly. (5) The crown type exemplifies the change of carpels into petals which are slender and reflexed. (6) In the bomb type we have the combination of doubling of both the stamens and the carpels, but the guard petals are still slightly different. (7) The fully double type is the rose where the petals are evenly arranged, very often indistinguishable from the guard petals. It is to be noted in this connection that extensive studies have revealed that fragrance increases with each successive type of doubling. The single peonies often possess a disagreeable odor, while the rose varieties are extremely fragrant.

The one criticism usually voiced against the peony is the short duration of the bloom. This is a serious drawback, but the season may be prolonged six weeks or more by the use of a number of different species. *P. tenuifolia* is the first to bloom in the spring, followed by *P. Witmanniana* hybrids in May, and a little later by *P. officinalis*. Early in June the shrubby *P. Moutan* makes its debut with a wonderful mass of large flowers. It is closely followed by another shrubby form, *P. lutea*—a somewhat rare and recent introduction with large golden yellow flowers. The last to bloom are the numerous varieties of early, midseason, and late types of *P. albiflora*.

From a cultural viewpoint the Paeonia (Ranunculaceae) may be classified under two heads—the herbaceous and the tree, the herbaceous kinds composing by far the larger group. The propagation of herbaceous peonies is comparatively a simple process. Seeds may be sown or the fleshy rootstocks

PAEONIA ARIETINA.

PAEONIA ANOMALA.

divided, but because of the variability and hybrid character of the plants, seeds are rarely used, except to produce new varieties. It is best to sow the seeds immediately after maturity, in sandy soil, about two inches deep. Soaking in water previous to planting is advisable to facilitate germination. Upon appearance of the seedlings above ground shading of lath or brush should be provided and the young plants allowed to remain in the seed-beds for at least a year. Propagation by root division should be accomplished in the fall after the tops have fully matured. The roots should be dug up and placed in a shady place for a few days. Then they may be cut in pieces containing at least three buds each.

P. albiflora and *P. officinalis* are the most important of the herbaceous species. *P. albiflora* is a native of northern Asia and withstands a large degree of cold. It was known to the Chinese previous to the sixth century, having been used by them for medicinal purposes, food, and later for ornamentation. It is readily distinguishable from the other species by bearing more than one flower upon the stem. A number of valuable varieties have been introduced, but its chief value lies in the wonderful results obtained from crossing with *P. peregrina, P. arietina,* and particularly *P. officinalis.*

P. officinalis is native of southern Europe and is apparently the species which secured for the genus its name Paeonia. A physician named Paeon was supposed to have used the roots of the plant in curing the wounds of Mars during the Trojan War. A good many legends concerning its properties have been handed down from the ancients, ascribing miraculous faculties to its use and presence. Even late in the nineteenth century the feeling prevailed among the peasants of Europe that evil spirits would be kept away by the presence of a peony plant near a house, which may explain to a certain extent the planting of one or two peonies at each cottage door.

Other species of herbaceous peonies of some ornamental value and deserving of mention are the following:

P. paradoxa, a native of Ile de Levant, France, quite late in blooming and producing small flowers on very short peduncles.

P. anomala, a Siberian species producing enormous roots which are eaten by the natives. The flowers are large, crimson, single.

P. tenuifolia, native of Ukraine, Russia, characterized by its linear leaves.

P. Wittmanniana, a pale yellow peony, desirable for its parentage in a number of valuable hybrids.

P. Emodii, the only species native of India, but closely allied to *P. albiflora.*

P. Brownii, rather insignificant but worth mentioning, being the only species native of the Western Hemisphere (California).

Of lesser importance may be mentioned *P. decora, P. arietina, P. humilis, P. peregrina,* and *P. corallina.*

The tree peony, *Paeonia Moutan,* is a native of China, its discovery dating previous to the sixth century, when it was cultivated for medicinal uses only. Later it was introduced into gardens for ornamental purposes, becoming a great favorite with the Japanese. The first shipment reached England in 1794 from where introduction into France was secured. A more recent addition to the tree peonies is *P. lutea,* with yellow flowers.

The tree peony is somewhat more difficult to propagate than the herbaceous type. Several methods are employed: seeds, grafting upon herbaceous peonies, layering, division of the roots, and cuttage.

The commonest method is by grafting upon the fleshy roots of the herbaceous types. The operation is performed in August or September, so that new roots will be developed before winter. A healthy piece of a root of *P. albiflora* is selected and slit about two inches from the crown downward. A scion with at least two buds is cut wedge-shaped, inserted into this slit, and bound tightly with raffia. The grafted plant is potted, leaving one eye of the scion above ground, and the pot is plunged into a cold-frame where it remains over winter and the following season. Cleft grafting upon the roots is sometimes practised with success, if plenty of wax is applied at the union.

Layering is best performed in the spring just before growth commences. The operation consists of bending down branches, making a slit on the under surface to encourage root formation, and pegging to the soil. It usually requires two years before the plant may be severed from its parent.

Division of the roots and cuttings of the stems are methods rarely practised. The former has a tendency to injure the plant, while the latter is rarely successful unless unusual precautions are employed. In order to have the cuttings root, they should be taken in August or September with a portion of the old wood attached, and planted in pots of sandy soil. A close atmosphere and shade are essential for success.

The growing from seed has the advantage of securing plants upon their own roots, but when it is realized that a year or more is required for germination and an additional five to six years before flowers are produced, the method is found to be too slow and precarious.

The soil required for the maximum development of peonies should be a somewhat heavy clay loam, especially if quality of blooming is considered. For propagation purposes, however, a lighter soil is preferable. A thorough preparation of the beds is necessary because of the deep-rooting, gross-feeding propensities of the plant. Stable manure is considered the most efficient of fertilizers, but should not be applied in too fresh a state, as rotting or general debility of the plant will result.

Early fall planting in September should be practised. The summer's growth is then completed and the winter buds formed at the crown. Spring planting is not advisable because of the unavoidable breaking off of the new rootlets which start very early in the spring, and a consequent checking of growth. After the soil has been plowed two feet deep in September and enriched with well-rotted manure, the roots may be lifted, divided, and planted in the new location, setting the plants three inches below the surface of the soil. This depth is essential to prevent freezing and heaving during winter. A slight mulch of straw, manure or litter is desirable.

In the spring the mulch may be worked into the soil and thereafter shallow cultivation and occasional watering is given to keep the plants in a healthy condition during the summer. A slightly shady position would be beneficial in localities with extreme summer heat, as during exceptionally hot weather the foliage becomes brown early in the summer, often necessitating its removal. Some species, however, like *P. tenuifolia,* naturally lose their foliage shortly after blooming, to reappear again next spring. During the season the *P. albiflora* varieties require disbudding in order to increase the size and improve the form and color of individual flowers.

Cut peonies would be appreciated to a greater extent were certain precautions taken in cutting. This should be done when the buds are just unfolding and rolling back the outer petals. Quick immersion into cold water to prevent air being drawn into the stems, and storage in a cool place until expanded will prolong the keeping qualities considerably. This is impracticable for commercial purposes, but if fol-

lowed as closely as possible would result in greater satisfaction among the flower-buying public.

Both the herbaceous and tree peonies are readily forced in the greenhouses. The plants should be lifted in September after completion of their growth, potted in rich soil, and plunged into a cold-frame, where they should remain until about December. When first placed in the greenhouses a temperature of 40–45° F. should be maintained, gradually being raised to 55–60° F. Under such treatment, with frequent applications of liquid manure, the tree peonies may be forced in six weeks and the herbaceous kinds in about eight to ten weeks. Double-flowering varieties should be used for forcing, their flowers possessing longer keeping qualities. After forcing at least two years should elapse before the same plants are forced again.

Comparatively, the peony is immune to insect attacks and in a lesser degree the same holds true for fungous diseases. By far the most important disease is the Botrytis blight, occurring simultaneously in widely separated localities, especially during a wet spring. It is caused by *Botrytis paeoniae* —a fungus belonging to a widely distributed genus attacking many ornamental and economic plants. The disease affects the stems, buds, and leaves. In the early spring an attack upon the stems often results in rotting and complete wilting. The buds are the next to succumb to the attack, indicated by wilting, drying up, or failure to open. In wet seasons as many as 90 per cent have been found blasted in this fashion. The leaves show symptoms of this disease in the form of blotches spreading from the apex, which soon become brown and dry. In all cases a thick felty covering of spores indicates the presence of the parasitic organism.

Due to the wide-spread nature of the disease, numerous hosts, and transference of spores by ants, methods of control are not efficacious. Spraying is not desirable because of the discoloration of the buds and foliage and the neutralization of copper in the Bordeaux mixture by the exuded sugary solution from the buds. Sanitary eradication measures promise a greater degree of success. Cutting away and burning the old stubble in the fall and replacing the old soil at the top by fresh sand, as well as removal of all infected stems in the spring, will reduce the chances of infection of the buds. Rotted buds full of spores should be removed and burned.

A number of other diseases have been observed, but in most cases they are not very serious and no effective meas-

CINCHONA OFFICINALIS.

ures of control have been devised for them. Among the number may be included the root gall, root rot, leaf blotch, mosaic, and Sclerotinia stem rot.

The following is a short selected list of some of the best peonies for garden use and cut-flowers:

Name	Color	Time of Bloom	Type
Avalanche	White	June	Crown
Baroness Schroeder	White	June	Rose
Couronne d'Or	White	June	Rose
Claire Dubois	Pink	June	Rose
Duchesse de Nemours	White	May	Crown
Delachei	Red	June	Rose
Edulis Superba	Pink	May	Crown
Eugene Verdier	Pink	Early June	Rose
Felix Crousse	Red	Early June	Bomb
Festiva Maxima	White	May	Rose
Grandiflora Rosea	Pink	June	Rose
La Printemps	Yellow	Early May	Single
Livingstone	Pink	June	Rose
La Tulipe	White	Early June	Rose
M. Jules Elie	Pink	May	Crown
M. Dupont	White	Early June	Rose
Modeste Guerin	Pink	Early June	Bomb
Marie Lemoine	White	June	Rose
Mme. de Verneville	White	May	Bomb
Mme. Ducel	Pink	May	Bomb
Rubra Superba	Red	Late June	Rose
Solfatare	Yellow	June	Bomb
Venus	Pink	June	Crown
Walter Faxon	Pink	June	Rose

QUININE

This valuable medicinal plant (*Cinchona officinalis*) is indigenous to the isolated districts of the western slopes of the Cordilleras, at an elevation of between 2,000 and 9,000 feet. The genus is named in honor of Countess Chinchon, wife of a Spanish viceroy of Peru, who was cured of fever in 1678, by the medicine extracted from the bark. This is known under several common names, as Peruvian bark, Countess' powder, Jesuits' bark, and quinine, the latter being derived from the Peruvian name, quinaquina, meaning "bark of barks."

A noteworthy specimen of *Cinchona officinalis* is in flower for the first time in St. Louis, and may be seen in the varied industries house at the Garden. Remarkable growth has developed since the plant was transferred from the old green-

houses, where crowded conditions necessitated growing in pots, and it is now twelve feet in height. The flowers are very fragrant and borne in massive drooping panicles, small, bell-shaped, white in color, with numerous fine hairs. The leaves are large, ovate, green with reddish venation.

The quinine tree yields its maximum amount of alkaloid when between six and nine years of age. Several methods are used in the collection of bark of both roots and stems: (1) The shoot or small tree is uprooted and entirely stripped of bark, this meaning the total loss of the plant. (2) The trunk is cut near the ground, the stump producing young shoots which form a fresh plant. (3) The bark is stripped in longitudinal layers, leaving sufficient bark between to prevent injury. The exposed strip is sometimes covered with moss for protection, and eventually is covered by the growth of the cambium which at the same time forms a fresh layer of bark. By using this latter method a continuous supply of bark is secured.

Quinine is now widely cultivated in India and Ceylon, where it was introduced in 1861. For this purpose collectors were sent to Peru to secure seeds, owing to the fact that the seeds lose their germinating power very soon after ripening. They were shipped to the Botanic Garden at Kew, where three thousand plants were grown and sent to India, Ceylon, and the West Indies, in Wardian cases. By 1893 these plants were fully established and quinine was made available for use by the natives, put up in five-grain doses and sold for one pice (about half a cent). Before this achievement, the Indian government purchased over 200,000 dollars' worth of quinine merely for the state of Bengal, which emphasizes the importance of the introduction of this plant into India alone.

NOTES

Mr. Alexander Lurie, Horticulturist to the Garden, attended the meetings of the American Society of Horticultural Science, at Pittsburgh, December 27–31.

At the Patriotic Food Show at the Coliseum, February 2-13, the Garden was represented by an exhibit of fungi and bacteria injurious to fresh and preserved food products.

A meeting of the Society of Sigma Xi was held in the graduate laboratory on February 15, Dr. L. R. Nickel giving an address on "The Battle of the American Chemical Industries."

On February 20, Mr. G. H. Pring, Floriculturist to the Garden, gave an illustrated lecture, at the Central Library,

before the St. Louis Natural History Museum Association on "Insect Pollination in Flowers."

The graduate lecture room at the Garden, as well as a large room in the basement, has been turned over to the Red Cross as a branch for the making of surgical dressings. This is the first surgical dressing shop to be opened on the South Side and is being well attended.

On January 1, Dr. B. M. Duggar, Physiologist to the Garden, lectured before the Brooklyn Institute of Arts and Sciences on "The Significance of Plant Diseases and the General Problems of Parasitism." He also presented a paper, on February 4, before the St. Louis section of the American Chemical Society on "Some Refinements in the Indicator Method of Hydrogen-Ion Determinations."

Among the recent visitors to the Garden were Dr. J. R. Wier, Forest Pathologist, U. S. Department of Agriculture, Missoula, Montana; Dr. Clifford H. Farr, of Texas Agricultural and Mechanical College; Prof. E. Meade Wilcox, of University of Nebraska; Dr. R. A. Studhalter, formerly Rufus J. Lackland Research Fellow, now Assistant Forest Pathologist, U. S. Department of Agriculture, San Francisco; Miss Ruth Beattie, Instructor in Botany, Wellesley College; and Mr. G. P. Van Eseltine, of the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

During March the Monday Afternoon Lecture Course of Washington University, held in Graham Memorial Chapel at 4:30 P. M., will consist of a series of talks on "Gardening," by members of the Garden staff. The dates and subjects for these are as follows:

1. March 4. Vegetable Gardens; Their Use and Misuse..... George T. Moore.
2. March 11. Production and Food Values.....B. M. Duggar.
3. March 18. What to Plant.....Alexander Lurie.
4. March 25. How to Plant.....Alexander Lurie.

STATISTICAL INFORMATION FOR JANUARY, 1918

GARDEN ATTENDANCE:

Total number of visitors	2,113

PLANT ACCESSIONS:

Total number of plants received as gifts	1

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	5
Total number of books and pamphlets donated	30

HERBARIUM ACCESSIONS:

By Purchase—

E. Bartholomew—"North American Uredinales," Cent. XVIII, Nos. 1701–1800 inclusive, Cent. XIX, Nos. 1801–1900 inclusive	200
Rev. John Davis—Ferns, chiefly from United States	290
F. C. Gates—Plants of northern Michigan	517
F. C. Gates—Plants of Illinois	131

By Gift—

E. Bartholomew—Fungi from western Missouri	2
R. H. Colley—Fungus on *Pinus Strobus* from Massachusetts	1
J. A. Drushel—*Ungnadia speciosa* Endl. from Texas	1
Dr. H. D. House—Fungi of New York	22
C. G. Lloyd—*Corticium lilacinofuscum* from Japan	1
John Macoun—Fungi of British Columbia	61
New York Botanical Garden, by Dr. W. A. Murrill—*Merulius hirsutus* Burt from type locality	1
Dr. J. R. Wier—Timber-destroying fungi of Montana	2
Dr. Mary S. Young—*Polygola sp.* from Texas	1

By Exchange—

New York Botanical Garden—Plants of the West Indies, chiefly from Jamaica	258
University of North Dakota—Plants of North Dakota	10
TOTAL	1.498

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

ANNE W. DAVIS,
Research Assistant.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI MARCH, 1918 No. 3

CONTENTS

	Page
The Indoor Bulb Show	29
Notes	38
Statistical Information	39

ST. LOUIS, MO.
1918
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

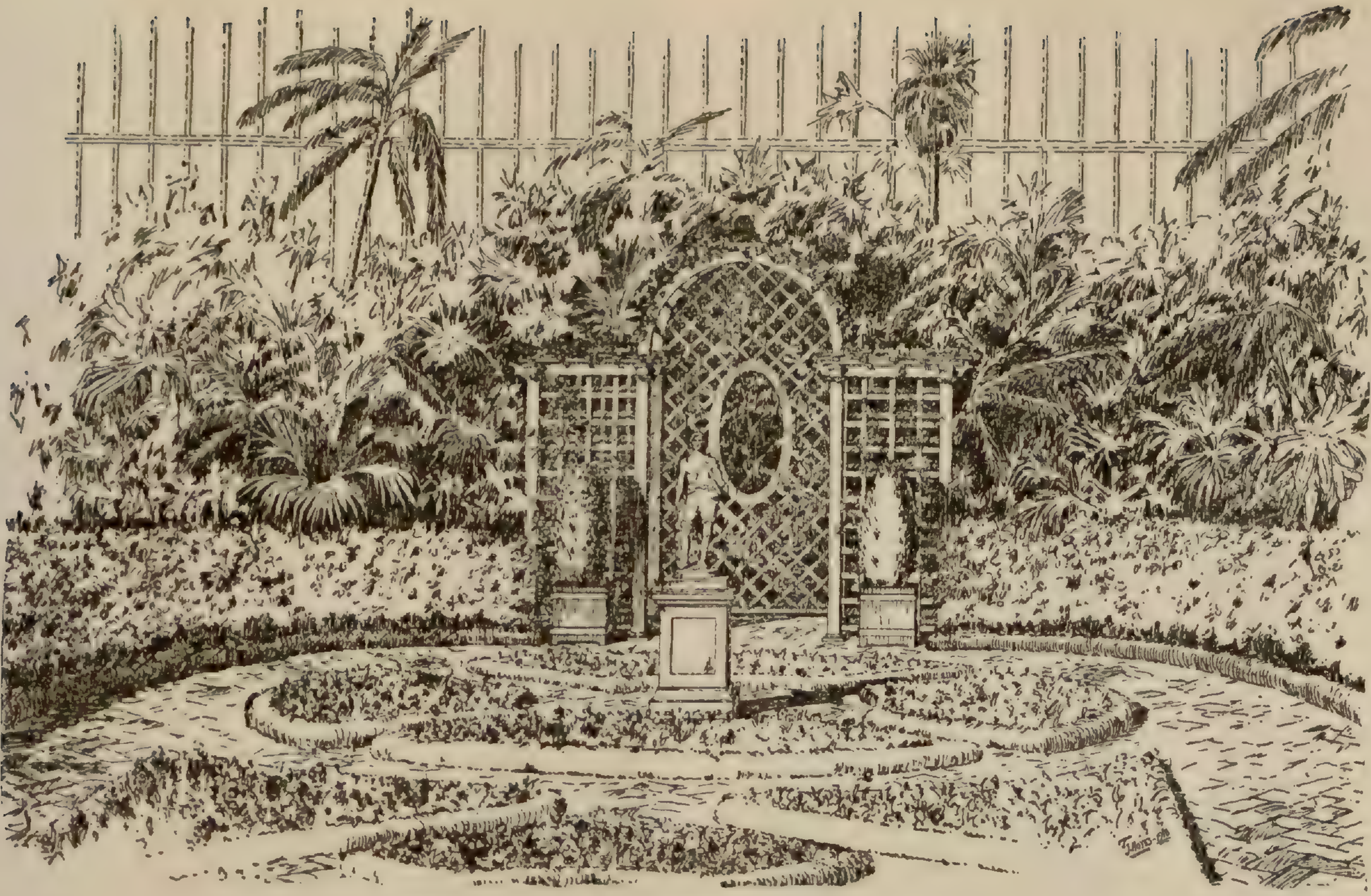
FREDERIC A. HALL,
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.



VIEW OF GARDEN IN FLORAL DISPLAY HOUSE.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., March, 1918 No. 3

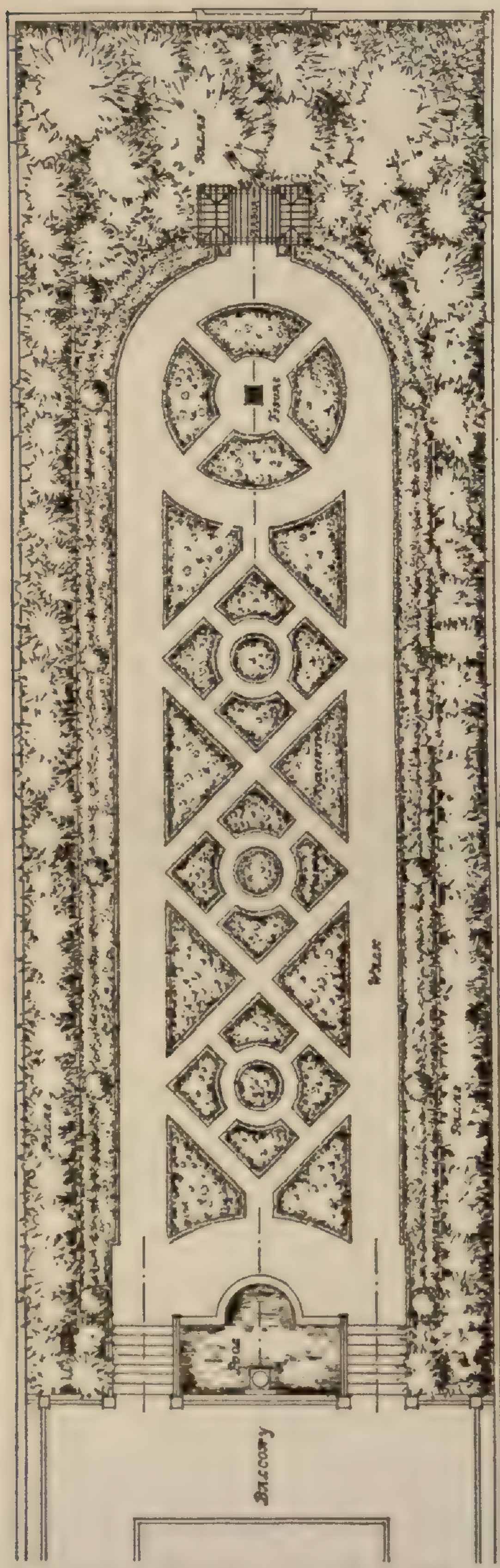
THE INDOOR BULB SHOW

The advent of spring is to be fittingly emphasized by the April indoor show in the floral display house at the Garden. The show will consist of the early-blooming bulbous plants which have become universally associated in the popular mind with the transition from the bleak days of winter to the brightness of the Easter season—lilies, hyacinths, tulips, and narcissus.

The flowers have been arranged in a formal garden of a simple parterre design unusually well adapted to the proportions of the floral display house. A new feature is a marble figure in the center of a circular bed at the north end, which is framed by the arbor beyond. The wall fountain and pool at the south end form a most important part of the effect produced. Hyacinths occupy the triangular beds and the small circular beds of the middle panel. The beds forming the squares of this part are filled with tulips, while the larger circle at the north end contains the narcissus and the hyacinth collections. At the sides are hyacinths, amaryllis, spiraea, and roses, and several pieces of topiary work at regular intervals. Borders of snakegrass, palms, and other exotics enclose the garden in a wall of green.

A special feature of the display will be a collection of 148 bulbs of hippeastrum, valued at $10,000, loaned to the Garden last October by John Scheepers Co., New York, to be grown and exhibited at the time of the National Flower Show which was to have been held in St. Louis in April. On account of war conditions the show had to be abandoned, but the Garden has made an extra effort to make up, in part at least, for the disappointment of those who had been looking forward to this floral treat. Mr. Scheepers visited Europe for the sole purpose of bringing to this country the finest of modern hybrids, and he believes that he secured the only specimens of the two rarest hippeastrums in ex-

istence, a pure albino variety under the popular name "White Lady" and a light pink variety called "Apple Blossom." St. Louisans are particularly fortunate in having the opportunity of seeing this unusual and noteworthy collection.



PLAN OF GARDEN IN FLORAL DISPLAY HOUSE.

HIPPEASTRUM (Amaryllis)

The development of this well-known genus covers a considerable period of activity on the part of the enthusiast and hybridist. It was well known in gardens before the Linnean period, and the old name Amaryllis suggests that it was named for the sweetheart of the Roman poet Virgil. *Sternbergia lutea* was described by John Gerard under the name *Narcissus autumnalis major*. Parkinson figured the same plant in his "Paradisus," as well as a red-flowered type, *Narcissus indicus*, which is popularly known at the present time as *Amaryllis formosissima*, native of Mexico and Guatemala. It was probably introduced into Spain previous to 1593.

In 1822 Dean Herbert published "The Production of Hybrid Vegetables" in the Transactions of the Royal Horticultural Society. Under this somewhat eccentric title he devised a complete systematic classification of the known species of

Amaryllis. The greater part of Herbert's life was devoted to the classification of the order and the cultivation of all the known amaryllis, numerous hybrids being raised. In a subsequent treatise the genus was separated, probably through the suggestions of Linnaeus, into Hippeastrum and Amaryllis, *Amaryllis Belladonna,* indigenous to the Cape of Good Hope, being the only remaining representative, while the western group embraced many species. The separation was not entirely geographical, however, but founded on minute botanical characters. Up to this period the genus had been named successively Narcissus, Lilio Narcissus, and Amaryllis, which, however, are readily differentiated. The liliums have a leafy stem without spathes, while the amaryllis produce naked flower stems with buds inclosed in spathes.

There are upwards of 70 described species of Hippeastrum, a number of which have been used in the production of the thousands of variable present-day hybrids. The most prominent species, *Hippeastrum Reginae,* a native of South America, was introduced and flowered by Fairchild of Hoxton, England, in 1728, under the name *Lilium Reginae.* It was figured in the Botanical Magazine, 1799, the flower being a short funnel-form variety, crimson in color. *Hippeastrum vittatum,* native of Peru, was imported into Europe in 1769, having white flowers prominently overlaid with red stripes, with a white keel. *Hippeastrum reticulatum,* native of Brazil, was introduced into England by Dr. Gray, in 1777, and was described in the Botanical Magazine, in 1803. The flowers of this species are mauve or purple-red, with cross lines and bars of crimson. *Hippeastrum equestre,* of tropical America, dates back to 1698, and is probably one of the earliest parents used in breeding. Its flowers are bright red with green at the base. Other imported species used are *Hippeastrum aulicum,* introduced from Brazil in 1819, *H. psittacinum,* introduced from Brazil in 1820, *H. solandriflorum* from Brazil, *H. pardinum* from Peru, and *H. Leopoldii. H. Johnsonii,* the first recorded hybrid, was raised, in 1799, by an English watchmaker named Johnson, who crossed *H. Reginae* and *H. vittatum.*

The development of Hippeastrum hybrids was taken up commercially by Veitch & Sons, of Chelsea, England, about 1870, resulting in a more open, regular flower. Large groups of these hybrids were exhibited at the annual shows of the Royal Horticultural Society of London. The work of improvement was later taken up by the Belgians, Dutch, and Germans. At the present time thousands of hybrids are

raised annually in California by Burbank, and in Florida by Nehrling.

There are two methods by which hippeastrums may be cultivated, (1) planting outside for the summer months, and (2) greenhouse or pot culture. The first method involves the planting out of bulbs in rows, during the month of May, in a well-drained border and top dressing with cow manure. During summer plenty of water and destruction of weeds are essential. In October the bulbs should be lifted and either potted, or stored in the bulb house and potted two or three weeks before the starting period. One objection to this method is the unavoidable breaking of the numerous thick, fleshy roots, which occurs in the process of lifting and potting, at the expense of the future flowers. It is advocated, however, for the increase of stock, through the agency of side growths which are produced more freely outside. Greenhouse or pot culture is without doubt more satisfactory when the production of perfect flowers is the object. The plants should be transplanted before the starting period, usually January, or top dressed, depending upon their condition. A good heavy soil should be selected, adding leaf mold and sand in proportion, and enriching it by applying bone meal or cow manure. Water should be given sparingly until the plants are well rooted. It is not necessary to transplant annually, but top dressing in alternate years, combined with feeding with liquid cow manure and soot-water, is desirable. After growth is completed, usually by the end of October, the water should be withheld gradually, and the temperature reduced from 60 to 45° F. for the resting period.

Mealy bug and thrips are the two chief insect pests, the former inhabiting the under side of the scales, the latter puncturing the epidermis of the succulent leaves. The mealy bug may be kept under control by forcible spraying, or, when badly infested, by brushing the bulbs with 50 per cent alcohol. Nicotine solution will control thrips.

Hippeastrums are easily raised from seeds, producing flowering bulbs within 4 years. Seeds should be sown immediately after ripening, as they soon lose their vitality. The best method is to sow in sandy soil in flats, placing the seeds about 2 inches apart to eliminate early transplanting. If properly grown, bulbs 1 inch in diameter may easily be obtained by the end of the first year, when they should be transplanted into 3-inch pots or set outside during the summer for further development.

THE LILY

No other flower upon display exemplifies the Easter season as does the lily. It has been associated so long with Easter decorations that its absence would be considered inappropriate. The lily is one of the oldest flowers known to mankind, having been mentioned in legends and verse from earliest times, though its history is shrouded in mystery. Parkinson (1869) was the first to describe accurately several different species, and he was later followed by Linnaeus in the "Systema Plantarum," in 1774. Many new forms were discovered by Thunberg and Siebold, which enabled M. Spae (1847) to publish a memoir containing 44 species. A complete classification of the lily was published in 1874 by Baker, which led to the standard work on the subject by H. J. Elwes, "A Monograph of the Genus Lilium." Of the 200–300 species that have been described, only four with their varieties are commonly used for indoor decoration—*Lilium longiflorum eximium* (*Harrisii*), *L. longiflorum giganteum, L. candidum, L. speciosum album, L. speciosum rubrum, L. speciosum Melpomene,* and *L. Henryi.*

The Easter lily, *Lilium longiflorum,* is a native of China, and is cultivated for decorative purposes to a larger extent than any other lily. The white tubular flowers of *L. longiflorum eximium* and *L. longiflorum giganteum* often reach 8 inches in length, while as many as 15–20 have been borne on a 4-foot stem. The average commercially grown plants, however, produce 3–5 flowers per plant. The susceptibility of *L. longiflorum eximium* to a bacterial disease has led to its being superseded by *L. longiflorum giganteum,* which differs from the former by greater vigor of the bulb and a reddish tinge of the stem.

The Madonna lily, *Lilium candidum,* is a native of the Mediterranean region, and is used quite extensively for forcing. It differs slightly from *L. longiflorum* in having smaller and more numerous flowers with a greater fragrance.

Lilium speciosum and its varieties, *rubrum* and *Melpomene,* rank next to *L. longiflorum* in their use for forcing purposes. The flowers are reflexed, white or pinkish with blood-red spots, 1–10 being borne on a stem. The varieties differ from the type in deeper coloration of the petals and somewhat different habit of growth. They are native of Japan.

Lilium Henryi is similar to *L. speciosum* in bulb and form of flowers but differs in habit and coloration. The flowers are more numerous, orange-yellow with reddish brown spots and a green band at the base. It is native of China.

One of the main factors in successful forcing of lilies is the development of a strong root system before any top growth is permitted. To accomplish this the bulbs are potted in the fall in 6-inch pots containing a compost of 3 parts loam and 1 part well-rotted manure, the pots being only half filled in order to allow for a top dressing when growth begins. The bulbs should then be stored outdoors in frames and covered with cinders, soil, or manure.

About 13–14 weeks before the time that flowers are desired, the pots should be brought into a greenhouse with a temperature of 45–50° F. at night, which is gradually raised in the course of 2 weeks to 60° F. With proper ventilation and weekly applications of liquid manure after the buds begin to show, no trouble should be experienced in producing well-flowered plants. Approximately 6–8 weeks are required for forcing lilies from the time that the buds appear. Application of water at a temperature of 70° F. is recommended, as well as shading the glass to draw up the stems to a desirable height. The lasting qualities of the flowers may be increased by the removal of the anthers upon opening of the blooms. This prevents the self-pollination and subsequent fertilization of the ovary, with rapid withering of the corolla. In addition, this practice prevents the spotting of the pure white bells with the sticky yellow pollen. Eradication of green aphis is essential to prevent malformation of the flowers.

NARCISSUS

The narcissus, a true harbinger of spring, was greatly prized in the ancient times. It was mentioned by Virgil some 2,000 years ago and later by Mohammed. In botanical works the first account of the daffodils occurs in Gerard's "Herbal," in 1597. In 1629 Parkinson figured it in his "Paradisus," while in 1724 numerous varieties were listed in Miller's "Gardeners' Dictionary." In modern times great impetus has been given to the popularity of narcissus by the classification and introduction of various types by Peter Barr.

In popular nomenclature great confusion exists as to the proper terminology for daffodils, jonquils, narcissi, Chinese sacred lilies, etc. The daffodils or trumpet narcissi differ from jonquils in having much larger trumpets and bearing flowers singly upon a flowering stem, while each jonquil stem bears 2–6 shallow-cupped yellow flowers resembling those of the paper-white narcissus. The much-prized sacred lily is but a variety of the paper-white narcissus.

The popularity of the narcissus is not confined merely to growing outdoors, as the demand in recent years for cut

flowers and pot-grown plants has been enormous. The principal species used for forcing are *N. Tazetta papyraceus* (paper-white narcissus), *N. Pseudo-Narcissus* (trumpet daffodil), *N. incomparabilis, N. Jonquilla,* and *N. poeticus.*

N. Tazetta produces 4–12 white flowers with shallow cups. It is an extremely variable species both as to color and size. The most important varieties are the common paper-white narcissus (*N. Tazetta papyraceus*) and the Chinese sacred lily (*N. Tazetta orientalis*), the latter being extensively grown in bowls of water.

N. Pseudo-Narcissus (trumpet daffodil), with its brilliant yellow single and double flowers, is one of the favorites. *N. incomparabilis* differs slightly from the trumpet daffodil in having a shorter trumpet, and is thought to be a hybrid between *N. Tazetta* and *N. Pseudo-Narcissus. N. Jonquilla* (jonquil) is a hardy species forced extensively for its small yellow shallow-cupped flowers produced upon slender stalks. *N. poeticus* is an old favorite easily recognized by the red-margined shallow cup and spreading white segments.

The majority of the bulbs are grown in Holland and to a certain extent in France. Upon their arrival in September, immediate potting is recommended to prevent drying out and thus impairing the quality of the flowers. The best soil is a mixture of equal parts of leaf mold, well-rotted manure, and fibrous loam, nitrogenous fertilizers tending to turn the flowers green. For cut-flower purposes the bulbs are usually placed close together in shallow flats, their tops being just level with the surface of the soil. When used as pot plants several bulbs are placed in a 6-inch pan. Care should be taken to provide sufficient drainage and not to press the bulbs into the soil, as this may compact the soil underneath to such an extent as to lift the bulb out of the earth when the roots begin to develop. Thorough watering and storage in a cold-frame in a manner similar to that practiced for lilies give best results. Subdued light is necessary upon removing the bulbs from the frames, in order to draw up the foliage and produce uniformity of bloom. At this time a temperature of 50° F. should be maintained, but as the light is increased the temperature is raised 10–15 degrees. Under proper conditions 4–6 weeks are required to bring the bulbs into bloom.

HYACINTH

Very little is known of the early history of the hyacinth. Gerard mentioned it in the "Herbal," but failed to state its origin or source of introduction. White, pink, and blue

varieties were then figured, but now the range of color is much greater, including yellows and reds of many shades.

The Dutch hyacinth (*Hyacinthus orientalis*) and the Roman hyacinth (*H. orientalis albus*) are the two types commonly forced. The latter differs from the former in a smaller bulb producing earlier flowers, usually of a pale pink, blue, or white color, and fewer on a stalk. The Dutch hyacinth produces a single stiff flowering stem from a bulb, as a rule, while the Roman hyacinth may produce three or four graceful spikes.

The propagation of the hyacinth is so distinct as to require a brief mention. In July fully ripened bulbs are taken out of the ground, and 3 or 4 cross cuts deep enough to reach the growing point made in the bottom. These bulbs are then placed in a trench, with the cut end upward, covered with soil, and allowed to remain a few weeks. As soon as the wounds are healed and the cuts opened wide the bulbs are taken up and placed in storehouses until October, when planting takes place. Upon being lifted next June the cuts are found to be lined with 20–30 small bulblets, while the substance of the old bulb has practically disappeared. The young bulbs are planted next fall in a similar manner to the old bulbs, this process being repeated for four or five years, until a mature flowering bulb is developed. Another method consists of scooping out the center of the bottom of the bulb instead of scoring it. More but smaller bulblets are secured in this manner, but the advantage of quantity is offset by the additional one or two years required to attain maturity.

The soil and conditions essential for proper forcing are similar to those of the narcissus, except that Dutch hyacinths are grown singly in pots. It is very necessary to produce a strong root system in order to have long healthy spikes of flowers. Low temperature, not above 65° F., is conducive to large flowers, more brilliant coloration, and longer lasting qualities. Usually for Dutch hyacinths 4–6 weeks are required for the proper development of the flowers after being brought from the frames. The Roman hyacinths may be forced in a much shorter time.

The Dutch hyacinth, as well as the Chinese sacred lily, is often grown in water. The principles of growth are the same as for potted bulbs, except that each bulb is so placed in a glass that the bottom is barely in contact with the water. It should then be set away in a cool, dark place for 8–10 weeks, until a strong root system has been developed and the growing shoot has reached 2–3 inches in length. By grad-

ually increasing the temperature and light, good flowers may be obtained, providing fresh water is added occasionally.

TULIP

Although it is well known that tulips are of extremely old garden origin, no exact records are in existence. It is thought that *Tulipa Gesneriana* and *T. suaveolens* are responsible for the common types of to-day. To the former are ascribed the late tulips, while the early-flowering varieties belong to the latter. Their cultivation in Europe dates back to 1554, when seed was brought to Austria from Turkey. The Turkish tulips were composed of pointed petals of red and yellow hues, but these were gradually, by a process of selection, changed to broad rounded forms of varying colors.

Two forms of *T. Gesneriana* are of importance in forcing, the long-stemmed, self-colored, large-flowered Darwins, and the Parrot tulips (*T. Gesneriana* var. *Dracontia*). It is thought that Parrot tulips are merely hybrids possessing deeply and fancifully cut petals, although the same condition may have been brought about by continuous selection. *T. suaveolens* differs from the others chiefly in earliness of bloom and comparative dwarfness. A garden hybrid between *T. Gesneriana* and *T. acuminata—T. retroflexa*—is of interest, possessing yellow funnel-form flowers with twisted, undulated edges.

Tulips are propagated by means of offsets and cutting of the old bulbs. While flowering, new bulbs are formed inside of the outer covering. Consequently the bulbs which are dug up from the beds in the spring are not the same that were planted in the fall. Thorough ripeness is essential for bulb production.

Pot culture of tulips does not differ from that of the other bulbous plants. Several bulbs are placed in a pan, watered, stored in frames, and then gradually forced into bloom in 3–4 weeks. Proper rooting is essential to develop long-stemmed, large flowers.

ASTILBE

Astilbe japonica, or, as it is erroneously called, Spiraea, belongs to the Saxifragaceae, and is a hardy herbaceous perennial, with compound foliage and tall, dense spikes of white, pink, or purplish flowers.

The clumps of plants are allowed to freeze outdoors, then are potted into a mixture composed of sandy loam and manure in ratio of 4 to 1, and grown on in the greenhouse at a temperature of 50° F. No higher temperature than

60° should be allowed, but copious quantities of water should be applied throughout the growing season and especially when the flower spikes begin to show color. Generally, three months are required to bring the plants into full flower.

Division of the clumps after forcing and growing them on in a cool place in the free ground outdoors for a year will produce new plants ready for forcing the year following. Astilbe is singularly free from attacks of diseases and insects.

NOTES

Mr. W. S. Wells spoke on "Thrift Gardens" at the Carnegie Library, Belleville, Illinois, March 18.

Dr. George T. Moore, Director of the Garden, gave a talk before the St. Louis Garden Club, March 12, on "Lawns."

Mr. Alexander Lurie, Horticulturist to the Garden, spoke on "Thrift Gardens" at the Wellston High School, March 8.

Mr. F. S. Collins, of Boston, is spending some time at the Garden working over the collection of algae in the herbarium.

An illustrated lecture on "Tree Surgery" was given before the St. Louis Gardeners' Club, March 6, by Mr. Alexander Lurie.

Dr. Norma E. Pfeiffer, of the University of North Dakota, has resumed at the Garden her monographic studies of the genus Isoetes.

Visitors to the Garden during March included Mr. J. F. Collins, Forest Pathologist, U. S. Department of Agriculture and Demonstrator, Brown University, Providence, Rhode Island; and the Rev. John Davis, of Hannibal, Missouri.

On March 28 fifty students from the St. Louis College of Pharmacy, accompanied by Professor Hemm of that institution, visited the Garden, and were conducted through the greenhouses and grounds by Mr. George H. Pring, Floriculturist to the Garden.

STATISTICAL INFORMATION FOR FEBRUARY, 1918

GARDEN ATTENDANCE:

Total number of visitors	8,478

PLANT ACCESSIONS:

Total number of packets of seeds received as gifts	10

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	53
Total number of books and pamphlets donated	57

HERBARIUM ACCESSIONS:

By Gift —	
E. Bartholomew—*Hydnum laeticolor* from western Missouri	1
O. C. Charlton—*Quercus sp.* from Dallas, Texas	1
Mrs. Joseph Clemens—Plants of Oklahoma	427
Prof. C. Conzatti—*Passiflora sp.* from Mexico	1
J. A. Drushel—Plants of Missouri, Ohio, Texas, and Colorado	12
Dr. W. G. Farlow—Fungi from Venezuela, Georgia, and New England	12
A. G. Johnson—Plants of Switzerland, collected by Miss Rosa Kuhn	82
Dr. J. Lunell—Plants of North Dakota	12
Dr. W. H. Long—*Merulius ambiguus* from New Mexico	1
Miss Ida M. Roper—American plants introduced into England through war conditions	7
By Exchange —	
Botanic Gardens, Sydney, N. S. W.—Plants of Australia	200
TOTAL	756

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

ANNE W. DAVIS,
Research Assistant.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI APRIL, 1918 No. 4

CONTENTS

	Page
The Economic Garden	41
Iris	54
Notes	57
Statistical Information	58

ST. LOUIS, MO.
1918
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL,
Chancellor of Washington University.

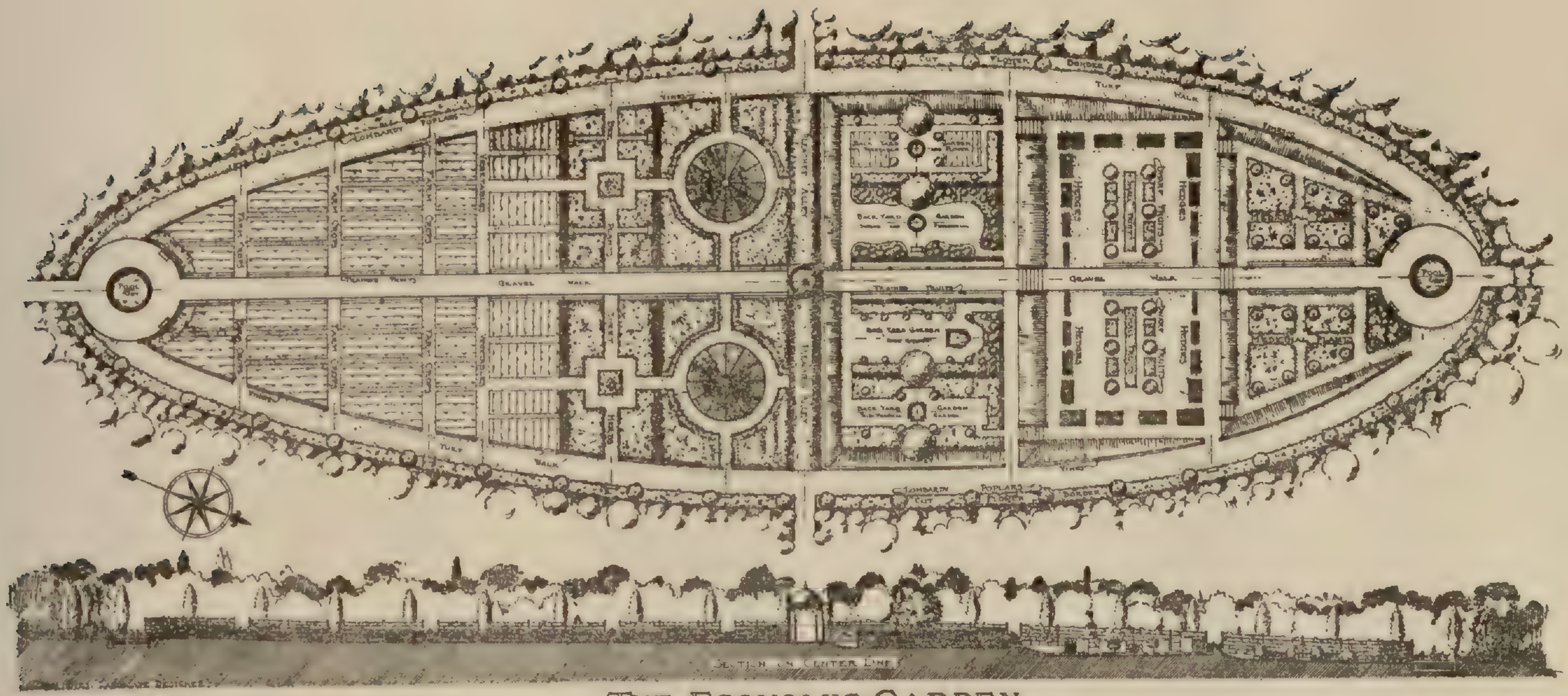
HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary



THE ECONOMIC GARDEN

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., April, 1918 No. 4

THE ECONOMIC GARDEN

One of the most popular, interesting, and instructive of the outdoor gardens is the economic garden, so named because of the material grown there. The value of this garden lies in the educational features embodied in its various sections, giving the city-dweller a comprehensive idea of the manner in which various economic plants are grown, as well as setting forth possibilities that may well be incorporated in his own home grounds.

This tract, about two acres in extent, is oval-shaped, divided from east to west through the center by a rough stone walk, bordered with birch which will eventually form a pleached alley. At the upper or south end, on either side the central walk, are located beds of farm crops, vegetables, savory herbs, bee plants, ornamental grasses, and lawn grasses. The north end is divided into three terraces. The first comprises four ideal back-yard garden arrangements; the next is devoted to hedges of various sorts, as well as dwarf and small fruits; and a medicinal garden occupies the last terrace.

At either end of the garden is a circular pool. The central north-and-south walk is lined throughout its length with trained fruits, while the outer border consists of trellis work supporting numerous hardy and tender vines. A cut-flower border surrounds the entire garden, which in turn is screened off from the main garden by a thick border plantation of trees and shrubs.

Farm Crops.—The plots in this section are mainly samples of crops to be grown upon a large acreage and used as staple articles of food or in the manufacture of economic products. Several crops are of such unusual interest as to require special mention, such as Mandan corn, teosinte, peanut, Australian salt bush, and beggarweed.

Mandan corn is described as the earliest-fruiting corn known and one which withstands drought, cold, and neglect.

Under most unfavorable conditions ears will mature in 70–90 days. The stalks are slender and short, with many suckers, bearing numerous ears. Through hundreds of years of selection by the Mandan Indians for perfection of ear and earliness of maturity this wonderful type has been developed for sections of the northwest and eastern slopes of the Rockies, where semi-arid conditions are prohibitive of successful agriculture. The purity of the various strains was preserved by the Indians, who held the corn sacred.

Teosinte, an annual forage plant closely related to corn and similar in appearance but forming no true ears, is a rank grower, reaching a height of 15 feet and producing as many as 60 stalks from a single root. Its great yielding property (20–30 tons per acre) would place teosinte at the head of all forage crops were it not for the fact that it will thrive only in moist, rich soil with a hot growing season. Only limited areas are devoted to its culture, the larger proportion of the crop being used as ensilage.

The peanut is an annual leguminous plant of creeping habit, with two kinds of flowers, the showy male and the hidden female. The former soon drop off, while the latter grow rapidly by the extension of the stem, which curves toward the ground, and becomes buried, to mature the pods. The seed is shelled before planting and is placed in loose soil 2 inches deep, 8 inches apart in the rows, 2 seeds being dropped at each place. Proper cultivation and ridging of plants is essential to further the development of the pods. Peanuts are used as roasted nuts, salted nuts, and for confectionery purposes. Peanut butter and peanut oil form extremely important by-products, while the vines form excellent forage.

Australian salt bush is a good cover crop upon alkaline soils and forms a forage of high quality, though the taste for it is acquired very gradually.

Beggarweed is an annual leguminous plant used as a cover crop for orchards, being a vigorous grower and having high nitrogen-producing property. If used for hay two crops may be cut during the season and the third crop allowed to mature seed, thus perpetuating the crop from year to year. Warm, moist soil and hot weather are conducive to its best development.

FARM CROPS

Common name	Botanical name
Alfalfa	*Medicago sativa*
Australian salt bush	*Atriplex semibaccata*
Barley	*Hordeum sativum*

Common name	Botanical name
Beggarweed	*Desmodium tortuosum*
Buckwheat	*Fagopyrum esculentum*
Burnet	*Poterium sp.*
Canadian field peas	*Pisum sativum* var. *arvense*
Clover, crimson	*Trifolium incarnatum*
Corn, broom	*Andropogon Sorghum*
Corn, field (Mandan)	*Zea Mays*
Corn, pop	*Zea everta*
Corn, sweet	*Zea saccharata*
Cotton	*Gossypium herbaceum*
Cowpea	*Vigna sinensis*
Flax	*Linum usitatissimum*
Furze	*Ulex europaeus*
Millet	*Panicum miliaceum*
Oats	*Avena sativa*
Peanut	*Arachis hypogaea*
Rape, dwarf Essex	*Brassica Napus*
Rice	*Oryza sativa*
Rye	*Secale cereale*
Sainfoin	*Onobrychis sativa*
Soy beans	*Glycine Soja*
Spelt wheat	*Triticum Spelta*
Spurry	*Spergula arvensis*
Sugar beet	*Beta vulgaris*
Sugar cane	*Saccharum officinarum*
Teosinte	*Euchlaena mexicana*
Timothy	*Phleum pratense*
Vetch	*Vicia villosa*

Vegetables.—Representative vegetables are grown on several plots, the following list including two little-known but desirable plants, udo and dasheen.

The udo is a hardy perennial producing strong, blanched shoots early in the spring, which may be cooked or used as a salad. It is readily grown from seed sown in a cold-frame in March. Upon reaching 4 inches in height the plants are set out in the open ground 3½ feet apart. Blanching is accomplished by mounding the soil over the tops, placing tile, boxes or tubs filled with sand over each plant, through which the shoots develop. After the removal of the crop full growth should be permitted, pinching out the flowers as they form. The turpentine flavor of the shoots is removed by boiling them 10 minutes in salt water.

The dasheen is a vegetable introduced into the United States in 1905 from Trinidad. It is closely related to our ornamental elephant's ear and is thoroughly adapted to cultivation in the warm, moist south Atlantic and Gulf states. In Florida, dasheens are planted in March, the tubers being placed 2 inches deep and 4 feet apart. The crop matures in October, when it may be harvested in a manner similar to the potato. Partial maturity has been obtained in the Garden by starting the tubers in the greenhouses in January,

but this, of course, is not practicable on a commercial basis. When fully grown the tubers, varying in color from white to violet, yield 4–30 pounds to a hill. Because of the 7-month requirement for maturity, it is not a profitable crop for cool climates. Dasheens are cooked in a manner similar to the potato and possess a nutty flavor which makes them an acceptable substitute for this popular vegetable.

VEGETABLES

Common name	Botanical name
Artichoke, globe	*Cynara Scolymus*
Artichoke, Jerusalem	*Helianthus tuberosus*
Asparagus	*Asparagus officinalis*
Beets	*Beta vulgaris*
Bean, common	*Phaseolus vulgaris*
Bean, Lima	*Phaseolus lunatus* var. *macrocarpus*
Brussels sprouts	*Brassica oleracea* var. *gemmifera*
Cabbage, Chinese	*Brassica Pe-tsai*
Cabbage, flat Dutch	*Brassica oleracea* var. *capitata*
Cabbage, Jersey Wakefield	*Brassica oleracea* var. *capitata*
Cabbage, red	*Brassica oleracea* var. *capitata*
Cardoon	*Cynara Cardunculus*
Carrot	*Daucus Carota*
Cauliflower	*Brassica oleracea* var. *botrytis*
Celery	*Apium graveolens*
Chicory	*Cichorium Intybus*
Chives	*Allium Schoenoprasum*
Collard	*Brassica oleracea* var. *gemmifera*
Corn salad	*Valerianella olitoria*
Cress	*Lepidium sativum*
Cucumber	*Cucumis sativus*
Dasheen	*Colocasia esculenta*
Egg plant	*Solanum Melongena*
Endive	*Cichorium Endivia*
Horseradish	*Radicula Armoracia*
Kale	*Brassica oleracea* var. *acephala*
Kohlrabi	*Brassica oleracea* var. *Caulo-Rapa*
Leek	*Allium Porrum*
Lettuce, head or leaf	*Lactuca sativa*
Mustard	*Brassica nigra*
Okra	*Hibiscus esculentus*
Parsley	*Carum Petroselinum*
Parsnip	*Pastinaca sativa*
Pea	*Pisum sativum*
Pepper	*Capsicum annuum*
Potato, sweet	*Ipomoea Batatas*
Pumpkin	*Cucurbita Pepo*
Radish	*Raphanus sativus*
Rhubarb	*Rheum Rhaponticum*
Sea-kale	*Crambe maritima*
Spinach	*Spinacia oleracea*
Squash	*Cucurbita moschata*
Tobacco	*Nicotiana Tabacum*
Tomato	*Lycopersicum esculentum*
Turnip	*Brassica Rapa*
Udo	*Aralia cordata*
Unicorn plant	*Martynia proboscidea*

Bee Plants.—In order to secure a quantity of honey of good quality, plants possessing flowering parts with an abundance of nectar acceptable in flavor to the bees, and affording easy access to the nectar glands, should be grown in close proximity to the hives. The following list comprises the plants grown in the garden which possess not only the above requirements, but provide a succession of bloom throughout the season:

BEE PLANTS

Common name	Botanical name
Alfalfa	*Medicago sativa*
Aster, white heath	*Aster ericoides*
Balm	*Melissa officinalis*
Bee-balm	*Monarda didyma*
Borage	*Borago officinalis*
Buckwheat	*Fagopyrum esculentum*
Catnip	*Nepeta Cataria*
Chowlee plant	*Vigna sinensis*
Chrysanthemum	*Chrysanthemum sp.*
Clover, Alsike	*Trifolium repens*
Clover, crimson	*Trifolium incarnatum*
Clover, Japan	*Lespedeza striata*
Clover, red	*Trifolium pratense*
Clover, sweet	*Melilotus alba*
Clover, white	*Trifolium repens*
Dandelion	*Taraxacum officinale*
Figwort	*Scrophularia nodosa*
Furze	*Ulex europaeus*
Giant spider plant	*Cleome spinosa*
Globe thistle	*Echinops sphaerocephalus*
Goldenrod	*Solidago sp.*
Knotweed	*Polygonum pennsylvanicum*
Lions' tails	*Leonurus Cardiaca*
Mustard	*Brassica nigra*
Peppermint	*Mentha piperita*
Rape, dwarf Essex	*Brassica Napus*
Sacaline	*Polygonum sachalinense*
Sainfoin	*Onobrychis sativa*
Sweet alyssum	*Alyssum maritimum*
Tickseed	*Bidens bipinnata*
Vetch, hairy	*Vicia villosa*

Savory Herbs.—Savory herbs are used for culinary purposes, to add flavor to dressings, soups, stews, and salads. The prevailing ignorance of their good qualities is responsible for their infrequent use and lack of demand. The comparative ease of cultivation should induce many to cultivate such common herbs as parsley, sage, thyme, savory, marjoram, spearmint, dill, fennel, balm, and basil. The following plants are grown in the section devoted to savory herbs:

HERBS

Common name	Botanical name
Agrimony	*Agrimonia officinalis*
Angelica	*Archangelica officinalis*

Common name	Botanical name
Anise	*Pimpinella Anisum*
Balm	*Melissa officinalis*
Basil, dwarf	*Ocimum minimum*
Basil, sweet	*Ocimum Basilicum*
Borage	*Borago officinalis*
Caraway	*Carum Carvi*
Catnip	*Nepeta Cataria*
Coriander	*Coriandrum sativum*
Cumin	*Cuminum Cyminum*
Dill	*Anethum graveolens*
Elecampane	*Inula Helenium*
Fennel, sweet	*Foeniculum dulce*
Horehound	*Marrubium vulgare*
Hyssop	*Hyssopus officinalis*
Lavender, true	*Lavandula vera*
Marjoram, sweet	*Origanum Majorana*
Mint, curled	*Mentha crispa*
Peppermint	*Mentha piperita*
Rosemary	*Rosmarinus officinalis*
Rue	*Ruta graveolens*
Sage	*Salvia officinalis*
Sage, red	*Salvia Horminum*
Savory, summer	*Satureia hortensis*
Savory, winter	*Satureia montana*
Spearmint	*Mentha viridis*
Tansy	*Tanacetum vulgare*
Thyme	*Thymus vulgaris*
Tarragon	*Artemisia Dracunculus*
Wormwood	*Artemisia Absinthium*

ORNAMENTAL GRASSES

Agrostis nebulosa
Agrostis pulchella
Arundo Donax
Avena sterilis
Briza geniculata
Briza gracilis
Briza maxima
Brizopyrum siculum
Bromus brizaeformis
Bromus macrostachys
Bromus madritensis
Chloris barbata
Chrysurus cynosuroides
Coix Lacryma-Jobi
Cortaderia argentea
Cortaderia Quila
Eleusine barcinonensis
Eleusine coracana
Eragrostis abyssinica
Eragrostis amabilis
Eragrostis elegans
Eragrostis maxima
Erianthus Ravennae
Eulalia japonica
Eulalia japonica var. *zebrina*
Festuca glauca
Gymnothrix japonica
Hordeum jubatum
Lagurus ovatus
Panicum atropurpureum
Panicum sulcatum
Pennisetum japonicum
Pennisetum latifolium
Pennisetum longistylum
Pennisetum Ruppellii
Stipa elegantissima
Stipa pennata
Zea Curagua
Zea Mays var. *gracillima*
Zea japonica var. *follis variegatis*
Zea japonica var. *gigantea quadricolor*
Phalaris arundinacea var. *variegata*

Lawn Grasses.—Two circular plots near the pleached alley are divided into 12 sections. Each section in one plot is devoted to a single kind of lawn grass, while the sections

in the other plot consist of mixtures of these individual grasses, suitable for various purposes. The following list indicates the grasses used, as well as the proportions in the mixtures:

GRASSES AND MIXTURES

1. English rye
2. Orchard grass
3. Red top
4. Bermuda grass
5. Canadian blue-grass
6. Rhode Island bent
7. Kentucky blue-grass
8. Sheep fescue
9. St. Augustine grass
10. Italian rye
11. White clover
12. Wood meadow grass

MIXTURES

1. General Purposes—

Red top	35 per cent
Kentucky blue-grass	35 per cent
Sheep fescue	10 per cent
English rye	20 per cent

2. General Purposes—

Kentucky blue-grass	50 per cent
Red top	20 per cent
Rhode Island bent	15 per cent
English rye	15 per cent

3. General Purposes—

Kentucky blue-grass	20 per cent
Rhode Island bent	30 per cent
English rye	40 per cent
White clover	10 per cent

4. Fair Green—

Kentucky blue-grass	30 per cent
Rhode Island bent	50 per cent
Sheep fescue	20 per cent

5. Shady Mixture—

Kentucky blue-grass	40 per cent
Wood meadow	40 per cent
Sheep fescue	20 per cent

6. Slopes—

Rhode Island bent	40 per cent
Wood meadow	25 per cent
Canadian blue-grass	25 per cent
Kentucky blue-grass	10 per cent

7. Extreme Heat—

Bermuda grass	50 per cent
Kentucky blue-grass	50 per cent

8. Extreme Heat—

Bermuda grass	60 per cent
Italian rye	40 per cent

9. General Purposes—

Italian rye	20 per cent
Canadian blue-grass	40 per cent
Red top	30 per cent
White clover	10 per cent

10. Sandy Soils—

Rhode Island bent	50 per cent
Orchard grass	20 per cent
Sheep fescue	30 per cent

11. Extreme Heat—

St. Augustine	40 per cent
Bermuda grass	60 per cent

12. Extreme Heat—

Bermuda grass	40 per cent
Kentucky blue-grass	50 per cent
White clover	10 per cent

Back-yard Gardens.— Four model back-yard gardens, each 28 x 60 feet, illustrate the effects that may be obtained in an average back yard. A full description of the subtropical, rose, shrubbery and perennial, and vegetable and flower

back-yard gardens is contained in the February, 1917, number of the BULLETIN.

Hedges.— The possibilities in the use of other plants than California privet for hedges are shown in the terrace devoted to this purpose. The various widths and heights illustrate the different effects obtainable.

HEDGE PLANTS

Common name	Botanical name
Althea, shrubby	*Hibiscus syriacus*
Aralia	*Aralia pentaphylla*
Barberry, box	*Berberis Thunbergii* var. *nana*
Barberry, Japanese	*Berberis Thunbergii*
Bridal-wreath	*Spiraea prunifolia*
Buckthorn	*Rhamnus cathartica*
Deutzia	*Deutzia scabra*
Dogwood, red Osier	*Cornus stolonifera*
Gumi	*Elaeagnus longipes*
Hawthorn	*Crataegus Oxyacantha*
Honey locust	*Gleditsia triacanthos*
Honeysuckle, fragrant	*Lonicera fragrantissima*
Honeysuckle, Morrow's	*Lonicera Morrowii*
Mock-orange	*Philadelphus inodorus*
Oregon grape	*Mahonia Aquifolium*
Privet, California	*Ligustrum ovalifolium*
Privet, Japanese	*Ligustrum Ibota*
Privet, yellow	*Ligustrum ovalifolium* var. *aureum*
Pearl bush	*Exochorda grandiflora*
Quince, Japanese	*Cydonia japonica*
Rose, Japanese	*Rosa rugosa*
Sea buckthorn	*Hippophae rhamnoides*
Spiraea	*Spiraea* "Anthony Waterer"
Stephanandra	*Stephanandra flexuosa*

Medicinal Section.— The plants in this group are arranged according to their botanical relationship. Many kinds of plants of varying medicinal importance are included in the collection. In obtaining the medicinal substances nearly all parts of the plant are employed. The entire root of belladonna, licorice, etc., is used; the bark of the root of sassafras and cotton; the entire herb of lobelia, pennyroyal, catnip; the leaves of belladonna, foxglove; the seed of poppy, castor bean, etc.

MEDICINAL PLANTS

Botanical name	Common name
Achillea Millefolium	Common milfoil, yarrow
Achillea santolinoides	
Acorus Calamus	Sweet flag
Actinomeris squarrosa	
Allium sativum	Common garlic
Althaea officinalis	Marshmallow
Anethum graveolens	Anet, dill

Botanical name	Common name
Antirrhinum majus	Snapdragon
Apocynum cannabinum	Canada or Indian hemp
Aquilegia vulgaris	Common columbine
Arctium Lappa	Burdock
Artemisia vulgaris	Mugwort
Asparagus officinalis	Common asparagus
Borago officinalis	Common borage
Calendula officinalis	Pot marigold
Cannabis sativa	Common hemp
Capsicum sativum	Red pepper
Chelidonium majus	Cock-foot, tetterwort
Chrysanthemum coccineum	
Convallaria majalis	Common lily-of-the-valley
Coriandrum sativum	Common coriander
Cynoglossum officinale	Common dog's tongue
Daucus Carota	Wild carrot
Dictamnus (Fraxinella) albus	White-flowered fraxinella
Digitalis purpurea	Common foxglove
Dipsacus atratus	Teasel
Dipsacus sylvestris	Wild teasel
Euphorbia marginata	Snow-on-the-mountain
Genista tinctoria	Base broom
Glycyrrhiza glabra	Licorice plant
Heuchera americana	Alum root
Humulus Lupulus	Common hop
Hydrastis canadensis	Golden seal
Hyssopus officinalis	Common hyssop
Inula Helenium	Horse elder
Iris cretensis	
Iris Pseudacorus	Jacob's sword, water flag
Iris tectorum	Wall iris
Iris versicolor	Large blue flag
Lavandula vera	True lavender
Leonurus Cardiaca	Common motherwort
Linaria vulgaris	Butter-and-eggs, toad-flax
Linum alpinum var. *album*	Dwarf white-flowered flax
Linum perenne	Perennial flax
Lycopersicum esculentum	Tomato
Malva rotundifolia	Dwarf mallow
Melilotus officinalis	Sweet clover
Mentha piperita	Peppermint
Mentha viridis	Spearmint
Monarda fistulosa	American wild bergamot
Narcissus poeticus	Poet's narcissus
Nepeta Cataria	Catnip
Ocimum Basilicum	Sweet basil
Opuntia vulgaris	Barbary fig
Oryza sativa	Rice
Paeonia officinalis	Common garden peony
Phytolacca decandra	Poke
Platycodon grandiflorum	Chinese bellflower
Polygonum hydropiperoides	Mild waterpepper
Radicula Armoracia	Common horseradish
Ranunculus bulbosus	Crowfoot, buttercup
Rheum compactum	Rhubarb
Rheum macropterum	
Rheum Rhaponticum	Garden or tart rhubarb
Ricinus communis	Castor bean

Botanical name	Common name
Rubus caesius	Bramble, dewberry
Rubus strigosus	Red raspberry
Rumex acutus	
Rumex Patientia	Herb Patience, spinage dock
Ruta graveolens	Rue
Salvia officinalis	Sage
Sanguinaria canadensis	Bloodroot
Satureia hortensis	Summer savory
Scrophularia nodosa	Knot-rooted figwort
Secale cereale	Common rye
Solanum Dulcamara	Bittersweet or woody nightshade
Spiraea Filipendula	Dropwort, Italian "May"
Statice Limonium	Common sea lavender, wild marsh beet
Symphytum officinale	Boneset
Tanacetum vulgare	Common tansy
Taraxacum officinale	Dandelion
Thymus vulgaris	Thyme
Urtica dioica	Common stinging nettle
Verbascum Thapsus	Common mullein
Veronica grandis	
Veronica virginica	Culver's root
Vinca minor	Common periwinkle
Zea Mays var. *indentata*	Common maise, Indian corn
Zea everta	Popcorn

Vines.— Aside from their ornamental value, vines are very useful on pergolas, trellises, and lattice work, shutting from view various unsightly objects. They serve also as a means of relieving the bareness of walls, thereby uniting the house with the lawn. The numerous annual and perennial climbers which will be planted at the base of the trellis work surrounding the garden illustrate the kinds which thrive in this vicinity, as well as their methods of attachment.

ANNUAL VINES

Botanical name	Common name
Adlumia cirrhosa	Mountain fringe vine
Bryonopsis laciniosa	Ornamental fruited vine
Cardiospermum Halicacabum	Balloon vine
Cobaea scandens	Mexican ivy plant
Convolvulus japonicus	Bindweed
Echinocystis lobata	Climbing cucumber
Humulus japonicus	Hop vine
Ipomoea Quamoclit	
Ipomoea Bona-nox	Moon vine
Ipomoea grandiflora	
Ipomoea setosa	Brazilian morning-glory
Ipomoea (mixed Japanese)	
Maurandia Barclaiana	
Mina sanguinea	
Momordica Balsamina	Balsam apple
Momordica Charantia	Balsam pear
Phaseolus multiflorus	Runner bean
Tropaeolum canariense	Nasturtium
Tropaeolum Lobbianum	Nasturtium (mixed)

PERENNIAL VINES

Botanical name	Common name
Actinidia arguta	
Actinidia polygama	Silver sweet vine
Akebia quinata	
Ampelopsis heterophylla	Variegated Virginia creeper
Ampelopsis Engelmannii	
Ampelopsis Lowii	Japanese ivy
Ampelopsis muralis	
Ampelopsis quinquefolia	Virginia creeper
Ampelopsis tricolor	Turquoise berry vine
Ampelopsis tricuspidata	Boston ivy
Apios tuberosa	Wild bean
Aristolochia Sipho	Dutchman's pipe
Aristolochia tomentosa	
Boussingaultia baselloides	Madeira vine
Clematis coccinea	Scarlet-flowered clematis
Clematis crispa	Curled-sepaled clematis
Clematis Flammula	Sweet-scented virgin's bower
Clematis florida "Duchess of Edinburgh"	Large-flowered clematis
Clematis Jackmanii	Jackman's clematis
Clematis Jackmanii "Madame Baron Veillard"	
Clematis lanuginosa var. *Henryi*	Wooly clematis
Clematis lanuginosa "Lady Caroline Nevill"	
Clematis lanuginosa var. *Lawsoniana*	
Clematis lanuginosa "Nelly Moser"	
Clematis orientalis	Oriental clematis
Clematis paniculata	Virgin's bower
Clematis patens "Fair Rosamond"	Open-flowered clematis
Clematis patens var. *Standishii*	
Clematis virginiana	American virgin's bower
Clematis Vitalba	Traveler's joy
Clematis Viticella "Ville de Lyon"	Purple virgin's bower
Celastrus orbiculatus	
Celastrus scandens	False bittersweet
Cucurbita Pepo	Gourd
Dioscorea Batatus	Cinnamon vine
Dioscorea villosa	American wild yam
Evonymus radicans	Spindle tree
Evonymus radicans var. *variegatus*	
Hedera cambwoodiana	
Hedera Helix	English ivy
Hedera Helix var. *arborescens*	Tree ivy
Hedera Helix var. *Crippsi*	Silver queen
Hedera Helix var. *latifolia*	
Hedera Helix var. *palmata*	
Humulus Lupulus	Hop
Hydrangea petiolaris	Climbing hydrangea
Ipomoea pandurata	Man-of-the-earth
Jasminum nudiflorum	Naked-flowering jasmine
Jasminum officinale	Jasmine
Lathyrus latifolius	Everlasting pea
Lonicera brachypoda	
Lonicera Caprifolium	
Lonicera flava	

Botanical name	Common name
Lonicera japonica	Honeysuckle
Lonicera japonica var. *aurea*	Honeysuckle
Lonicera japonica var. *chinensis*	Honeysuckle
Lonicera japonica var. *Halliana*	Honeysuckle
Lonicera perictymenum var. *belgica*	Woodbine
Lonicera sempervirens	Trumpet honeysuckle
Lycium barbarum	Matrimony vine
Lycium chinense	Chinese box thorn
Menispermum canadense	Moonseed
Passiflora caerulea	Passion vine
Passiflora incarnata	Wild passion flower
Periploca graeca	Silk vine
Polygonum baldshuanicum	Knot weed
Pueraria Thunbergiana	Kudzu vine
Smilax hispida	Bamboo brier
Solanum Dulcamara	Bittersweet
Tecoma grandiflora	Trumpet vine
Tecoma radicans	Trumpet creeper
Vitis aestivalis	Summer grape
Vitis arborea	
Vitis Berlandieri	Winter grape
Vitis bicolor	Blue grape
Vitis Champinii	
Vitis Coignetiae	Crimson glory vine
Vitis cordifolia	
Vitis Henryana	
Vitis Labrusca	
Vitis megalophylla	
Vitis rotundifolia	American bull grape
Vitis Thomsonii	
Vitis vulpina	Frost grape
Wistaria sinensis	Chinese wistaria
Wistaria sinensis var. *alba*	
Wistaria frutescens	American wistaria
Wistaria multijuga	Japanese loose-clustered wistaria

Trained Fruit Trees.—The central walk of the economic garden is lined with trees of apple, pear, peach, plum, cherry, nectarine, and gooseberry, trained in various ways. The modes of training upon espaliers are cordon, fan-shaped, gridiron, and verrier. In a cordon two branches are permitted to develop, each attached to a single wire. A short trunk with several branches radiating from its top in a single plane constitutes the fan-shaped espalier. In gridiron training two main horizontal branches ascend in the form of a gridiron. The verrier system consists of developing two or more sets of horizontal branches, emanating from the main trunk, one above the other, the ends being bent upwards into vertical shoots. Tree training of this sort is essentially an Old-World custom, having been evolved under intensive culture and patient hand-work. Only painstaking care and thorough understanding of the fruiting habits will lead to any degree of success.

Cut-flower Border.— Many annuals and perennials are desirable not only for the pleasing effects produced in masses, but also because of the quantity of cut-flowers produced which may be used for home decorating.

The representative collection grown in the cut-flower border does not exhaust the list of plants possible, but is comprehensive enough for general purposes.

CUT-FLOWER BORDER

Common name	Botanical name
African marigold	*Tagetes patula*
Aster	*Aster patens*
Aster	*Aster nova-angliae*
Aster	*Aster* "St. Egwin"
Bachelor's button	*Centaurea Cyanus*
Bachelor's button	*Gomphrena globosa*
Beard-tongue	*Pentstemon barbatus*
Blanket flower	*Gaillardia grandiflora*
Blazing star	*Liatris elegans*
Blazing star	*Liatris scariosa*
Bleeding-heart	*Dicentra spectabilis*
Candytuft	*Iberis umbellata*
Candytuft	*Iberis sempervirens*
Canterbury bells	*Campanula Medium*
China aster	*Callistephus chinensis*
Chinese bellflower	*Platycodon grandiflorum*
Chrysanthemum	*Chrysanthemum uliginosum*
Clarkia	*Clarkia elegans*
Columbine	*Aquilegia vulgaris*
Columbine	*Aquilegia chrysantha*
Columbine	*Aquilegia canadensis*
Coral bells	*Heuchera sanguinea*
Cone-flower	*Rudbeckia bicolor*
Cone-flower	*Rudbeckia triloba*
Cone-flower	*Rudbeckia subtomentosa*
Corn poppy	*Papaver Rhoeas*
Cosmos	*Cosmos bipinnatus*
Dahlia	*Dahlia coccinea*
Everlasting flower	*Helichrysum monstrosum*
Everlasting	*Acroclinium roseum*
False dragon-head	*Physostegia virginiana*
Farewell-to-spring	*Godetia amoena*
Four o'clock	*Mirabilis Jalapa*
Foxglove	*Digitalis purpurea*
Heliopsis	*Heliopsis Pitcheriana*
Hollyhock	*Althaea rosea*
Japanese false goat's beard	*Astilbe japonica*
Larkspur	*Delphinium grandiflorum* var. *chinense*
Larkspur	*Delphinium formosum*
Lavatera	*Lavatera trimestris*
Lupine	*Lupinus nanus*
Madonna lily	*Lilium candidum*
Maltese cross	*Lychnis chalcedonica*
Marigold, African	*Tagetes erecta*
Mexican tulip poppy	*Hunnemannia fumariaefolia*
Mignonette	*Reseda odorata*

Common name	Botanical name
Mist flower	*Eupàtorium ageratoides*
Monk's hood	*Aconitum autumnale*
Mourning bride	*Scabiosa caucasica*
Mullein pink	*Lychnis Coronaria*
Peony	*Paeonia officinalis*
Periwinkle	*Vinca rosea*
Petunia	*Petunia* (mixed)
Phlox	*Phlox paniculata* (pink)
Phlox	*Phlox paniculata* (white)
Poppy, California	*Eschscholtzia californica*
Poppy, oriental	*Papaver orientale*
Red-hot poker plant	*Tritoma Pfitzerii*
Sea lavender	*Statice Limonium*
Shasta daisy	*Chrysanthemum Leucanthemum*
Silver thistle	*Eryngium amethystinum*
Snapdragon	*Antirrhinum* (mixed)
Sneezeweed	*Helenium autumnale*
Soapwort	*Saponaria Vaccaria*
Stocks	*Matthiola incana*
Stokes' aster	*Stokesia cyanea*
Sunflower	*Helianthus annuus*
Sunflower	*Helianthus mollis*
Sweet Sultan	*Centaurea moschata*
Sweet William	*Dianthus barbatus*
Tickseed	*Coreopsis lanceolata*
Tickseed	*Coreopsis coronata*
Tobacco	*Nicotiana affinis*
Yellow day-lily	*Hemerocallis flava*
Youth-and-old-age	*Zinnia elegans*

IRIS

This showy, hardy outdoor plant is very popular, and its common, less expensive varieties are extensively used. It is to be regretted, however, that advantage is so rarely taken of the many beautiful new forms which have been introduced into this country. The comprehensive collection at the Missouri Botanical Garden, located in the central section of the perennial garden, in front of the Linnean house, represents most of the common and many rare types, and should prove of value in popularizing some of the better varieties which are not as yet very widely known.

The iris may be popularly divided into three classes: German or tuberous rooted, Japanese or fibrous rooted, and Spanish or bulbous.

In the German group may be included *Iris germanica, I. florentina, I. pallida, I. flavescens, I. plicata, I. neglecta, I. lurida, I. sambucina, I. squalens,* and *I. hybrida.* Owing to their diversity of origin, the varieties of this group range in color from pure white through mauve and blue to purple. The flower stalks are branched, extending above the light green, flat, sword-like leaves. Two flowers are usually borne on a stem, the inner segments curved inward, the outer curv-

ing outward with a tuft of hairs near the base. The flowering period extends from late May through June.

The Japanese iris (*I. laevigata* or *I. Kaempferi*) differs from the German group in possessing fibrous roots, somewhat more slender, parallel leaves, and flat, expanded flowers free of the crest of hair, ranging in color from white through purple and blue. A moist, cool location is desirable for best results. The flowering season begins in June and continues through July.

The Spanish iris (*I. Xiphium* and *I. Xiphoides*), a dwarf, bulbous form, partly hardy, is effective because of strong color contrasts and numerous flowers. The flowers, appearing in May and June, are borne singly, having recurved segments, the outer being broader and of more brilliant hue.

The iris is easily grown. Any rich, moist, light soil will give satisfactory results, though the Japanese types require a greater degree of moisture. The common method of propagation is by division of the roots, early in the fall or spring. It is preferable that this be done in the fall in order that the plants may be established in the ground before winter. After the ground freezes a light mulch of manure or litter will help prevent heaving and loss of plants. Division of the clumps every three years is desirable, especially in the case of the tuberous iris, to avoid the matting and gradual elevation of the roots to the surface of the ground. Thorough cultivation should be practiced during the entire growing season.

Despite the numerous varieties of iris there is room for betterment through hybridization. Pollination is effected by removing the anthers when the flower first opens and preserving them in vials until ready to apply to the stigma of the flower selected for pollination, the anthers of the female parent having previously been removed and the entire bloom covered with cheese-cloth or a paper bag to prevent insect pollination. The pollen is usually viable for the period of a week. The stigma is located near the apex of the petal-like style and is ready for pollination when the upper edge drops down and exposes the upper surface. The seeds germinate readily, being either sown in the open ground in the fall or started indoors in the winter and planted out in the spring. Two or three years are required before flowers appear.

The Garden collection is arranged botanically as follows:

SUBGENUS EVANSIA

(CHARACTERIZED BY A SLENDER CREEPING RHIZOME, THE OUTER SEGMENTS OF FLOWERS DISTINCTLY CRESTED)

***Iris cristata*, dwarf blue**

***Iris tectorum*, lilac**

SUBGENUS POGONIRIS

(CHARACTERIZED BY A SHORT THICK RHIZOME, AND OUTER SEGMENTS OF FLOWERS BEARDED)

Iris pumila var. *atroviolacea*, deep purple
Iris pumila var. *caerulea*, sky-blue
Iris pumila var. *lutea*, yellow
Iris pumila var. *alba*, white
Iris pumila var. *hybrida*, white
Iris biflora, purple
Iris hybrida "Balceng," white
Iris hybrida "Bridesmaid," white
Iris hybrida "Canary-bird," bright yellow
Iris hybrida "Eburna," white
Iris hybrida "Josephine," white
Iris variegata "Ada," canary-yellow
Iris variegata "Adonis," yellow
Iris variegata "Beaconsfield," crimson
Iris variegata "Ganymede," yellow
Iris variegata "Marie Corelli," primrose-yellow
Iris variegata "Mrs. Neubronner," yellow
Iris variegata "Princess of Teck," yellow
Iris amoena "Donna Maria," white
Iris amoena "Innocenza," ivory-white
Iris amoena "Jungfrau," white
Iris amoena "Mrs. H. Darwin," white
Iris amoena var. *reticulata alba*, violet
Iris amoena "Victorine," blue
Iris pallida "King Edward," blue
Iris pallida var. *dalmatica*, lavender
Iris pallida "Albert Victor," blue
Iris pallida "Glory of Hillegom," blue
Iris pallida "Her Majesty," rose-pink
Iris pallida "Khedive," lavender
Iris pallida "Madame Pacquitte," claret
Iris pallida "Leonidas," mauve
Iris neglecta var. *amabilis*, pale lilac
Iris neglecta "Cottage Maid," silvery blue
Iris neglecta "Florence Barr," rose-lilac
Iris neglecta "Frederick," lavender
Iris neglecta "Othello," dark blue
Iris neglecta "Wm. Wallace," blue
Iris squalens "A. F. Barron," bronze
Iris squalens "Bronze Beauty," yellow
Iris squalens "Dr. Bernice," copper
Iris squalens "Gypsy Queen," smoked pearl
Iris squalens "Lord Grey," rose-fawn
Iris squalens "Mr. Shaw," fawn
Iris squalens "Sir Walter Scott," bronze-yellow
Iris albicans, white
Iris albicans var. *Biliottii*, blue-purple
Iris flavescens, yellow
Iris florentina, creamy white
Iris lurida, mahogany
Iris sambucina, coppery rose
Iris trojana, pale blue
Iris plicata "Agnes," white
Iris plicata "Bleu Parfleur," dark blue
Iris plicata "Hebe," white
Iris plicata "Madame Chereau," white
Iris plicata "Sappho," white
Iris plicata "Sparte," pearly lavender
Iris germanica "Argus," dark purple
Iris germanica "Kharput," violet
Iris germanica "Major," purple-blue

SUBGENUS APOGON

(CHARACTERIZED BY A FIBROUS ROOT SYSTEM WITH NO BEARD OR CREST UPON THE SEGMENTS OF FLOWERS, THOUGH THEY ARE SOMETIMES PUBESCENT)

Iris longipetala, violet-blue
Iris sibirica, blue
Iris sibirica "Distinction," violet
Iris sibirica var. *grandis*, violet
Iris sibirica var. *lactea*, milky white
Iris missouriensis, lilac
Iris fulva, coppery maroon

Iris versicolor, violet-blue
Iris orientalis, brilliant blue
Iris orientalis "Blue King," blue
Iris orientalis "Snow Queen," ivory-white
Iris orientalis var. *gigantea* (*ochroleuca*), yellow
Iris aurea
Iris spuria, lilac-blue
Iris spuria var. *alba*, white
Iris laevigata (*Kaempferi*) "Chadai," white
Iris laevigata "Fascination," blue
Iris laevigata "Hodai," violet-blue
Iris laevigata "Hanaaoi," blue
Iris laevigata "Hino Dezurn," white
Iris laevigata "T. S. Ware," garnet
Iris laevigata "Koko-No-Iro," royal purple
Iris laevigata "Meiran," lavender
Iris laevigata "Osho-Kun," Tyrian blue
Iris laevigata "Samidare," violet-blue
Iris laevigata "Shiratki," silver-white
Iris laevigata "Senjo-No-Hara," crimson
Iris laevigata "Tora-Odori," purple
Iris laevigata "Tsurigi-No-Mai," blue-purple
Iris laevigata "Triumph," maroon
Iris laevigata "Uchui," purple
Iris laevigata "Wm. Tell," blue
Iris laevigata "Yomo-No-Umi," lavender-blue
Iris laevigata "Yedo-Jiman," blue

NOTES

Dr. George T. Moore, Director of the Garden, gave a talk on "Gardening" before The Town Club on April 13.

Mr. W. S. Wells gave a talk on "Thrift Gardens" before the Bryan-Mullanphy Parent-Teachers' Association, on April 9.

Miss Clara Fuhr, former pupil in the School for Gardening, has been appointed Leader of Boys' and Girls' Clubs in St. Louis County and surrounding towns.

Dr. E. A. Burt, Librarian and Mycologist to the Garden, is visiting the Gray Herbarium of Harvard University, where he will spend several weeks in research work.

Mr. G. H. Pring, Floriculturist to the Garden, gave a talk on "Vegetable Planting" at a mass meeting of the St. Louis Association of Gardeners, at the Public Library, April 3.

Mr. C. W. Dodge, Rufus J. Lackland Fellow 1917-18, and Mr. P. A. Kohl, former pupil in the School for Gardening, have entered army service. Mr. Dodge will receive his training at Camp Devon, Mass.; and Mr. Kohl at Camp Grant, Ill.

Mr. Alexander Lurie, Horticulturist to the Garden, published an article during the month in "The Missouri Woman" on "Thrift Gardens"; and an article on "Planting" was contributed by him to the April number of the "Garden Magazine."

Mr. Alexander Lurie, Horticulturist to the Garden, talked on "Diseases and Insects Injurious to Thrift Gardens" at a mass meeting of the St. Louis Association of Gardeners, at the Public Library, April 3; and on April 4, he spoke at a meeting of the East St. Louis Civic Association, at the East St. Louis High School, on "Trees."

Volume V, Number 1, of the Annals of the Missouri Botanical Garden has appeared during the month, with the following contents:

"Rhizopogon in North America," S. M. Zeller and Carroll W. Dodge.

"Monograph of the North and Central American Species of the Genus Senecio—Part II," J. M. Greenman.

STATISTICAL INFORMATION FOR MARCH, 1918

GARDEN ATTENDANCE:

Total number of visitors	20,550

PLANT ACCESSIONS:

Total number of packets of seeds received in exchange	211
Total number of plants and seeds received as gifts	103

PLANT DISTRIBUTION:

Total number of plants and seeds distributed in exchange	116

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	28
Total number of books and pamphlets donated	103

HERBARIUM ACCESSIONS:

By Purchase—	
B. F. Bush—Plants of Missouri	488
Rev. John Davis—Plants of South Carolina	117
Rev. John Davis—Plants of California	89
By Exchange–	
College de Longueuil, by Bro. Marie-Victorin—Plants chiefly from Quebec, Canada	374
University of Wisconsin, by Dr. J. J. Davis—"Fungi Wisconsinenses Exsiccati," Decade V, Nos. 41–50, inclusive	10
By Gift—	
B. F. Bush—Plants of Missouri, collected by Rev. John Davis	101
Mrs. Joseph Clemens—Fungi of Oklahoma and Texas (24), and one specimen of *Polypodium sp.* from Borneo	25
J. A. Drushel—Plants of Colorado and Utah	4
John Macoun—Polyporaceae of British Columbia	43
Geo. L. Moxley—Plants of California	16
Dr. J. R. Weir—Fungi from Montana	11
TOTAL	1,278

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director,

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

ANNE W. DAVIS,
Research Assistant.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener. *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI MAY, 1918 No. 5

CONTENTS

	Page
Gift of Plants by Mr. D. S. Brown	59
Winter Injury to Plants in the Garden	69
Notes	71
Statistical Information	72

ST. LOUIS, MO.
1918
PUBLISHED MONTHLY BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL,
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary

CATTLEYA DUSSELDORFFEI VAR. UNDINE.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., May, 1918 No. 5

GIFT OF PLANTS BY MR. D. S. BROWN

Through the generosity of Mr. D. S. Brown, of Kirkwood, Missouri, the Missouri Botanical Garden has become the possessor of the major portion of his magnificent collection of orchids, palms, cycads, and various other plants. In fact, with the exception of the cypripediums, all the contents of Mr. Brown's greenhouses are now to be found at the Garden.

For a period of more than thirty years Mr. Brown has been interested in bringing together rare and valuable plants, and he has been successful to a degree seldom equaled by any individual, his collection being recognized throughout the world as one of the finest of its kind in existence. It is impossible to refer particularly to the vast number of interesting plants which he has given to the Garden, but those familiar with the various groups will be able to gain from the lists printed below some idea of the importance of his contribution and of the magnitude of the collection of orchids, palms, etc., now to be found at the Missouri Botanical Garden.

Among the more notable orchids may be mentioned the extremely rare pure albino forms represented by *Cattleya Dusseldorffei* var. *Undine* (*Cattleya intermedia alba* × *Cattleya Mossiae Wageneri*) raised by Capt. Holford, of England. Both of the white parents were also donated. *Cattleya Skinneri* var. *alba* is another of the white types, as well as numerous plants of *Dendrobium virginale*. Other rare varieties include numerous brassocattleyas, the best of which is *Brassocattleya Veitchii* var. Queen Alexandra. These hybrids were derived by crossing *Brassavola Digbyana* with mauve-colored cattleyas, resulting in the brilliantly tinted flowers with fringed lips. Also included were numerous plants of the hybrids Brassolaelia, Sophrocattleya, and Laeliocattleya, the last-named being especially useful for the floral display in the orchid alcoves.

Among the palms contributed, three stand out as most rare: *Kentia Brownii* is the only palm of its kind in existence to-day and *Bismarckia nobilis* is found in but few col-

lections, while *Phytelephas macrocarpa* (ivory-nut palm) is interesting because of the use of its seeds as a substitute for ivory in making buttons. Some of the huge specimens required extreme care in transportation; a thirty-foot *Caryota urens* (fish-tail palm) with graceful, fern-like foliage; a thirty-foot *Phoenix dactylifera* (fruiting date palm), which bears fruit every year; and a giant forty-foot *Livistona chinensis* (cabbage palm) being among those safely established at the Garden. The additions to the Garden collection of palms, which was already unusually complete, are listed below:

Acanthophoenix crinita
Acrocomia mexicana
Archontophoenix Alexandrae
Areca furfuracea
Arenga Engleri
Bismarckia nobilis
Brahea macrocarpa
Calamus erectus
Caryota Mooreana
Caryota urens
Cocos Bonneti
Howea Belmoreana aurea
Howea Belmoreana variegata
Jubaea spectabilis
Kentia Brownii
Kentiopsis macrocarpa
Livistona Hoogendorpii
Livistona humilis
Martinezia corallina
Martinezia erosa
Maximiliana Maripa
Phoenix rupicola
Phoenix zeylanica
Phytelephas macrocarpa
Rhapis flabelliformis variegata
Sabal Blackburniana
Sabal oleraceum
Thrinax Chuco
Thrinax elegantissima
Thrinax radiata

As the result of the addition of several large tree ferns donated by Mr. Brown, the appearance of the fern house is more attractive than ever. The two most noteworthy plants are *Cyathea medullaris* (thirty feet) and *Cyathea dealbata* (twenty feet). Some of the rare ferns are: *Cyathea dealbata, Cyathea medullaris, Dicksonia antarctica, Dicksonia Chamissoi, Dicksonia regalis, Dicksonia squarrosa,* and *Dicksonia Wendlandi Verschaffeltii.*

The Garden collection of cycads, considered the most complete in this country, has been augmented by the addition of the following rare species: *Cycas Bellefonti, Cycas Micholitzii, Cycas siamensis, Encephalartos Lehmannii,* and *Macrozamia plumosa.*

The specimen of the common cycad, *Cycas revoluta* (sago palm), deserves special mention, it being at least three hundred years old and unusually well branched. This plant was exhibited by the Japanese Government at the Pan-American Exposition in Buffalo, in 1900, where it was acquired by Mr. Brown.

Several araucarias, not previously possessed by the Garden, are: *Araucaria Cookii, Araucaria Cunninghamii, Araucaria excelsa* var. *Goldieana, Araucaria excelsa* var. *Muelleri,* and *Araucaria Rulei.*

MR. D. S. BROWN IN HIS ORCHID HOUSE AT KIRKWOOD.

MOVING A SPECIMEN OF LIVISTONA CHINENSIS TO THE GARDEN.

Numerous anthuriums, both of the flowering and variegated-leaved varieties, as well as a comprehensive collection of nepenthes (pitcher plants), were also included.

The gift of Mr. Brown has placed in the possession of the Garden the most complete collection of orchids in the United States. Exclusive of the cypripediums, 115 genera and 691 species are represented.

ORCHIDS, EXCLUDING CYPRIPEDIUMS AND SELENIPEDIUMS, IN GARDEN COLLECTION

(Nomenclature that of Rolfe and Hurst, The Orchid Stud Book, and Sander's Orchid Guide.)

Acampe multiflora
*Aerides Ballantineanum**
*Aerides expansum**
Aerides expansum var. *Leonaei*
Aerides longiculcaratum
Aerides falcatum
Aerides Fieldingii
Aerides Houlletianum
*Aerides multiflorum**
*Aerides odoratum**
Aerides odoratum var. *majus*
Aerides odoratum var. *purpurascens**
Aerides quinquevulnerum
Aerides Sanderianum
*Aerides Savageanum**
*Aerides speciosa**
Aerides suavissimum
*Aerides virens**
Aerides virens var. *Dayanum*
Aerides virens var. *Ellisii**
Aerides virens var. *purpurascens**
Amblostoma sp.
Angraecum Chailluanum
Angraecum distichum
Angraecum Dubuysonii
*Angraecum eburneum**
Angraecum Eichlerianum
Angraecum Humblotii
Angraecum modestum
*Angraecum Sanderianum**
Angraecum Scottianum
Angraecum sesquipedale
Angraecum superbum
Anguloa Ruckeri
Arpophyllum giganteum

Barkeria elegans
Bifrenaria Harrisoniae
Bletia sp.
Brassavola cucullata
Brassavola cuspidata
Brassavola Digbyana
Brassavola nodosa
Brassavola venosa
Brassia sp.
Brassia brachiata
Brassia caudata
*Brassia Gireoudeana**
Brassia Lawrenceana var. *longissima*
Brassia maculata
Brassia verrucosa
Brassocattleya × *Cordelia* var. (*B. Digbyana* × *C. intermedia alba*)* G.H.[1]
Brassocattleya × *Empress of Russia* (*B. Digbyana* × *C. Mendelii*)* G.H.
Brassocattleya × *Empress of Russia* var. (*B. Digbyana* × *C. Mendelii alba* ♀)* G.H.
Brassocattleya × *Holfordii* (*B. Digbyana* × *C. Forbesii* ♀)* G.H.
Brassocattleya × *Leemanniae* (*B. Digbyana* × *C. Dowiana*)* G.H.
Brassocattleya × *Mariae* (*B. Digbyana* × *C. Warneri*)* G.H.
Brassocattleya × *Maronae* (*B. Digbyana* × *C. Warscewiczii*) G.H.
Brassocattleya × *Pluto* (*B. Digbyana* × *C. granulosa*)* G.H.
Brassocattleya × *Siren* (*B. Digbyana* × *C. Skinneri*)* G.H.
Brassocattleya × *Veitchii* (*B. Digbyana* × *C. Mossiae* ♀) G.H.
Brassocattleya × *Veitchii* var. *Queen Alexandra* (*B. Digbyana* × *C. Mossiae Wageneri*)* G.H.
Brassolaelia × *Gratrixiae* (*B. Digbyana* × *L. cinnabarina*)* G.H.

---

* Gift of D. S. Brown.
[1]G.H.= Garden hybrid.

Brassolaelia × *Helen* (*B. Digbyana* × *L. tenebrosa* ♀)* G.H.
Brassolaelia × hybrid (*B. Digbyana* × *L. grandis* ♀)* G.H.
Brassolaelia × hybrid (*B. Digbyana* × *L. majalis*)* G.H.
Brassolaelia × *Veitchii* (*B. Digbyana* × *L. purpurata*)* G.H.
Broughtonia sanguinea
Bulbophyllum sp.
Bulbophyllum Careyanum
Bulbophyllum Cassiopeia?
Bulbophyllum cupreum
Bulbophyllum fuscum
Bulbophyllum Lobbii
Bulbophyllum Medusae
Bulbophyllum Pechei
Bulbophyllum recurvum

Calanthe Laselliana? G.H.
Calanthe × *Orpetiana* G.H.
Calanthe × *Whiteana* G.H.
Calanthe × *Bryan* (*C. vestita rubro oculata* × *C. Regnieri Williamsii*) G.H.
Calanthe × *Bryan* var. *Wm. Murray* (*C. vestita rubro oculata* × *C. Regnieri Williamsii*) G.H.
Calanthe × hybrid G.H.
Calanthe Regnieri
Calanthe Regnieri var. *Williamsii*
Calanthe × *Veitchii* (*C. rosea* × *C. vestita*) G.H.
Calanthe × *Veitchii* var. *Sandhurstiana* (*C. rosea* × *C. vestita rubro oculata*) G.H.
Calanthe vestita var. *Turneri*
Catasetum sp.
Catasetum Christyanum
Catasetum ciliatum
Catasetum macrocarpum
Catasetum macrocarpum var. *folium variegatum*
Catasetum maculatum
Catasetum maculatum var. *Wailesii*
Catasetum maculatum var. *luteopurpureum*
Catasetum Oerstedii
Catasetum planiceps
Catasetum pileatum
Catasetum × *splendens* (*C. macrocarpum* × *C. pileatum*) N.H.[1]
Catasetum tabulare
Catasetum trifidum
Catasetum viride-flavum

Cattleya × *Alfredi* var. (*C. Trianae alba* × *C. granulosa*)* G.H.
Cattleya × *Armstrongiae* (*C. Loddigesii* × *C.* × *Hardyana*)* G.H.
Cattleya aurantiaca
Cattleya bicolor
Cattleya × *Boadicea* (*C. Gaskelliana* × *C.* × *Hardyana*)* G.H.
Cattleya Bowringiana
Cattleya × *Browniae* (*C. Bowringiana* × *C. Harrisoniana*)* G.H.
Cattleya (Brownhurst seedling)* G.H.
Cattleya × *Cooksonii* var. (*C. Trianae alba* × *C.* × *Hardyana alba*)* G.H.
Cattleya × *Daphne* (*C. Harrisoniana* × *C. Schilleriana*)* G.H.
Cattleya Deckeri
Cattleya Dowiana
Cattleya × *Dusseldorffei* var. *Undine* (*C. intermedia alba* × *C. Mossiae Wageneri*)* G.H.
Cattleya × *Edwardi* (*C. Schilleriana* ♀ × *C. Warscewiczii*)* G.H.
Cattleya × *Ella* (*C. bicolor* × *C. Warscewiczii*)* G.H.
Cattleya Eldorado var. *Wallisii*
Cattleya Forbesii
Cattleya Gaskelliana
Cattleya Gaskelliana var. *alba**
Cattleya Gaskelliana var. *albescens**
Cattleya guttata var. *Leopoldi*
Cattleya Harrisoniana
Cattleya × hybrid (*C. Dubuysoniana* × *C. labiata*)* G.H.
Cattleya × hybrid (*C.* × *Hardyana* × *C. velutina*)* G.H.
Cattleya intermedia
Cattleya intermedia var. *alba**
Cattleya × *Iris* (*C. Dowiana* × *C. bicolor* ♀)* G.H.
Cattleya labiata
Cattleya labiata var. *albescens**
Cattleya Leopoldi
Cattleya Lindleyana
Cattleya × *Luceaniana* (*C. Harrisoniana* × *C. Leopoldi*) G.H.
Cattleya Lueddemanniana
Cattleya (Manda's seedling)*
Cattleya maxima

* Gift of D. S. Brown.
[1]N.H.= Natural hybrid.

Cattleya Mendelii
Cattleya Mendelii var. *Wilsoni**
Cattleya × *Moira* (*C.* × *Fabia* × *C.* × *Mantinii*)* G.H.
Cattleya Mossiae
Cattleya Mossiae var. *Conference**
Cattleya Mossiae var. *Wageneri* × *C. Mossiae* var. *Wageneri** G.H.
*Cattleya** N.H.
Cattleya × *O'Brieniana* var. *alba* (*C. dolosa* × *C. Loddigesii*)* G.H.
Cattleya × *Patrociana* var. *aurea* (*C. Leopoldi* ♀ × *C. Loddigesii*)* G.H.
Cattleya Percivaliana
*Cattleya quadricolor**
Cattleya quadricolor var. *alba**
Cattleya × *Rafaeliae* var. *alba* (*C. Dowiana* ♀ × *C. Trianae*)* G.H.
*Cattleya Rex**
Cattleya × *Robert de Wavrin* var. *Westonbert* (*C. Schilleriana* × *C. Schroederae*)* G.H.
Cattleya × *Rothschildiana* (*C. Dowiana* × *C. Gaskelliana*)* G.H.
Cattleya Schroederae
Cattleya Schroederae var. *alba**
Cattleya Schroederae var. *albescens**
Cattleya Schroederae var. *Brownhurst**
Cattleya seedling
Cattleya seedling (Roehr's white var.)*
Cattleya Skinneri
Cattleya Skinneri var. *alba**
Cattleya Skinneri var. *alba magnifica**
Cattleya × *Stuartii* var. (*C. Mendelii magnifica* × *C. Mossiae*) G.H.
Cattleya × *suavior* var. (*C. intermedia alba* × *C. Mendelii*) G.H.
Cattleya superba
Cattleya × *Thayeriana* var. (*C. intermedia alba* ♀ × *C. Schroederae*)* G.H.
Cattleya Trianae
Cattleya Trianae var. *albescens**
Cattleya Trianae var. *delicata**
Cattleya Trianae (dark var.)*
Cattleya Trianae var. *pallida*
Cattleya Trianae (Roehr's type)*
Cattleya Trianae var. *Schroederae**
Cattleya × *Victoria Regina* (*C. labiata* × *C. Leopoldii pernambucensis*) G.H.
Cattleya Warscewiczii
Cattleya × *Williamsii* (*C. Gaskelliana* × *C. Harrisoniana* ♀) G.H.
*Chysis sp.**
Chysis bractescens
Chysis × *Chelsoni* (*C. bractescens* × *C. laevis*) G.H.
Cirrhopetalum Lendyanum?
Cirrhopetalum maculosum
Cirrhopetalum Thouarsii
Cirrhopetalum vaginatum
Coelia Baueriana
Coelia triptera
Coelogyne asperata
Coelogyne barbata
Coelogyne cristata var. *alba*
Coelogyne Dayana
Coelogyne fimbriata
Coelogyne flaccida
Coelogyne fuscescens
Coelogyne graminifolia
Coelogyne lactea
Coelogyne lentiginosa
Coelogyne Massangeana
Coelogyne ovalis
Coelogyne pandurata
Coelogyne psittacina
Coelogyne Rhodeana
Coelogyne Rossiana
Coelogyne speciosa
Coelogyne speciosa var. *major*
Coelogyne Swaniana
Coelogyne tomentosa
Coryanthes macrantha
Cycnoches Warscewiczii
Cymbidium affine
Cymbidium aloifolium
Cymbidium Devonianum
Cymbidium × *eburneo-Lowianum* (*C. eburneum* × *C. Lowianum*)* G.H.
Cymbidium elegans
Cymbidium ensifolium
Cymbidium Finlaysonianum
Cymbidium giganteum var. *Traceyanum*
Cymbidium insigne
Cymbidium lancifolium
Cymbidium Lowianum
Cymbidium pendulum
Cymbidium sinense
Cymbidium Traceyanum

* Gift of D. S. Brown.

Cymbidium tigrinum
Cyrtopodium sp.
Cyrtopodium Andersonii
*Cyrtopodium Godseffianum**

*Dendrobium sp.**
Dendrobium aggregatum
Dendrobium × *Ainsworthii* (*D. aureum* × *D. nobile*) G.H.
Dendrobium × *Ainsworthii* var. *Leechianum* (*D. aureum* × *D. nobile Cypheri*)* G.H.
Dendrobium × *Ainsworthii* var. *splendidissimum* (*D. aureum* × *D. nobile albiflorum*) G.H.
Dendrobium × *Ainsworthii* var. *splendidissimum albens* (*D. aureum* × *D. nobile* var.)* G.H.
Dendrobium × *Ainsworthii* var. *splendidissimum flavescens* (*D. aureum* × *D. nobile* var.)* G.H.
Dendrobium × *Ainsworthii* var. *splendidissimum grandiflorum* (*D. aureum* × *D. nobile* var.)* G.H.
*Dendrobium albo-sanguineum**
Dendrobium × *Andromeda* (*D.* × *Ainsworthii* × *D.* × *Cassiope*) G.H.
Dendrobium bigibbum
Dendrobium × *Cassiope* (*D. moniliforme* × *D. nobile albiflora*) G.H.
Dendrobium chrysanthum
Dendrobium chrysotoxum
Dendrobium clavatum
Dendrobium crassinode
Dendrobium crepidatum
Dendrobium crumenatum
Dendrobium Dalhousieanum
*Dendrobium Dearei**
Dendrobium × *dulce* (*D. aureum* × *D. Linawianum*)* G.H.
Dendrobium × *dulce Brownhurst* var. (*D. aureum* × *D. Linawianum*)* G.H.
Dendrobium × *Euryalus* var. *grandiflorum* (*D.* × *Ainsworthii grandiflorum* × *D. nobile nobilius*)* G.H.
Dendrobium Euryalus var. *magnificum* (*D.* × *Ainsworthii* × *D. nobile*)* G.H.
Dendrobium Farmeri
Dendrobium fimbriatum
Dendrobium fimbriatum var. *oculatum*
Dendrobium formosum var. *giganteum*
Dendrobium × *Gem* (*D. Ainsworthii* × *D. aureum*) G.H.
Dendrobium × *chlorostele* (*D. Linawianum* × *D. Wardianum*) G.H.
Dendrobium gracile
Dendrobium gracilicaule
Dendrobium hybrid
*Dendrobium hybridum**
Dendrobium Kingianum
Dendrobium Macraei
Dendrobium macrophyllum
Dendrobium × *Melpomene* (*D.* × *Ainsworthii splendidissimum* × *D. signatum*)* G.H.
Dendrobium moschatum
Dendrobium moschatum var. *cupersum**
Dendrobium nobile
Dendrobium nobile var. *Ballianum*
Dendrobium nobile var. *Burfordense**
Dendrobium nobile var. *Cooksonianum*
Dendrobium nobile var. *Dominianum**
Dendrobium nobile var. *elegans*
Dendrobium nobile var. *giganteum*
Dendrobium nobile var. *nobilius**
Dendrobium nobile var. *pulchellum*
Dendrobium nobile var. *R. Ashworth**
Dendrobium nobile var. *Rappartianum**
Dendrobium nobile var. *roseum*
Dendrobium nobile var. *rotundiflorum**
Dendrobium nobile var. *rubellum*
Dendrobium nobile var. *Sanderianum*
Dendrobium nobile (Thwaites' var.)*
Dendrobium nobile var. *virginale**
Dendrobium nobile var. *virginale alba**
Dendrobium nobile (Weetman's var.)*
Dendrobium Parishii
Dendrobium × *Perfection* (*D.* × *Euryalus Apollo grandiflorum* × *D. nobile nobilius*)* G.H.
Dendrobium Phalaenopsis var. *Schroederianum*
Dendrobium Pierardii

* Gift of D. S. Brown.

Dendrobium primulinum
*Dendrobium regium**
Dendrobium × *Rolfae* (*D. nobile* × *D. primulinum*) G.H.
Dendrobium Roxburghii
*Dendrobium Sanderae**
Dendrobium × *Schneiderianum* (*D. aureum* × *Findlayanum*)* G.H.
Dendrobium secundum
Dendrobium superbum
Dendrobium thyrsiflorum
Dendrobium × *Vulcan* var. (*D.* × *chlorostele album* × *D. Wardianum album*)* G.H.
Dendrobium Wardianum
Dendrobium × *Wiganiae* var. *album* (*D. nobile* var. × *D. signatum* var.)* G.H.
Diacrium bicornutum

Epidendrum sp.
Epidendrum alatum
Epidendrum alatum var. *majus*
Epidendrum anceps
Epidendrum aromaticum
Epidendrum atropurpureum
Epidendrum atropurpureum var. *roseum*
Epidendrum auritum
Epidendrum bifarum
Epidendrum bractescens
Epidendrum Brassavolae
Epidendrum Candolle
Epidendrum ciliare
Epidendrum conopseum
Epidendrum densiflorum
Epidendrum elongatum
Epidendrum falcatum
Epidendrum fragrans
Epidendrum × *Kewense* (*E. erectum* × *E. xanthium*) G.H.
Epidendrum microbulbon
Epidendrum nematocaulon
Epidendrum nemorale
Epidendrum nocturnum
Epidendrum × *O'Brienianum* (*E. erectum* × *E. radicans*) G.H.
Epidendrum ochraceum
Epidendrum odoratissimum
Epidendrum oncidioides
Epidendrum pachysepalum
Epidendrum Parkinsonianum
Epidendrum patens
Epidendrum pentotis
Epidendrum polybulbon
Epidendrum purpurascens
Epidendrum radiatum
Epidendrum ramosum
Epidendrum raniferum
Epidendrum rigidum
Epidendrum scabrum
Epidendrum Stamfordianum
Epidendrum tampense
Epidendrum tessellatum
Epidendrum umbellatum
Epidendrum variegatum
Epidendrum xanthinum
Epicattleya × *Nebo* (*C. Claesiana* × *E. O'Brienianum*) G.H.
Eria sp.
Eria albido-tomentosa
Eria flava
Eria gigantea
Eria stellata
Eria velutina
Eulophia monophylla

Gomesa fragrans
Gomesa planifolia
Gomesa recurva
Gongora sp.
Gongora galeata
Gongora leucochila

Hartwegia purpurea
Hexadesmia crurigera

Laelia acuminata
Laelia anceps
Laelia anceps var.
Laelia anceps var. *alba**
Laelia anceps var. *Brilliant**
Laelia anceps (extra dark var.)*
Laelia anceps (extra large var.)*
Laelia anceps var. *Hilliana**
Laelia anceps var. *morada*
Laelia anceps var. *Sanderiana**
Laelia anceps var. *Schroederiana**
Laelia anceps var. *Stella*
Laelia anceps var. *vestalis*
Laelia anceps (white lip)*
Laelia anceps (white var.)
Laelia autumnalis
Laelia Boothiana
Laelia crispa
Laelia × *Euterpe* (*L. crispa* × *L. Dayana*) G.H.
Laelia harpophylla G.H.
Laelia glauca
*Laelia Gouldiana**
Laelia grandis var. *tenebrosa*
*Laelia Lindleyana**
Laelia × *nigrescens* (*L. pumila* ♀ × *L. tenebrosa*) G.H.
Laelia × *Pacavia* (*L. purpurata* × *L. tenebrosa*)* G.H.

* Gift of D. S. Brown.

Laelia × *Pacavia* var. (*L. tenebrosa* (yellow) × *L. purpurata* (*white*))* G.H.
Laelia Perrinii
Laelia pumila var. *praestans*
Laelia purpurata
Laelia rubescens
Laelia superbiens
Laeliocattleya × *Acis* (*C. Mendelii* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Aphrodite* (*C. Mendelii* ♀ × *L. purpurata*) G.H.
Laeliocattleya × *Astorae* (*C. Gaskelliana* × *L. xanthina*) G.H.
Laeliocattleya × *Barbarossa* (*L. C.* × *Callistoglossa* × *C. Trianae*)* G.H.
Laeliocattleya × *Bedouin* (*L. purpurata* × *L. C.* × *Hyeana*)* G.H.
Laeliocattleya × *Bedouin* var. (*L. C.* × *Hyeana splendens* × *L. purpurata*)* G.H.
Laeliocattleya × *Bertha* (*L. grandis* × *C. Schroederae*)* G.H.
Laeliocattleya × *Birkbeckii* (*L. C.* × *Greenwoodii* × *C. Mendelii*)* G.H.
Laeliocattleya × *Bletchleyensis* (*C. Warscewiczii* × *L. tenebrosa*) G.H.
Laeliocattleya (Brownhurst seedling)* G.H.
Laeliocattleya × *Callistoglossa* (*C. Warscewiczii* × *L. purpurata*) G.H.
Laeliocattleya × *Canhamiana* (*C. Mossiae* × *L. purpurata*) G.H.
Laeliocattleya × *Canhamiana* var. (*C. Mossiae alba* × *L. purpurata alba*)* G.H.
Laeliocattleya × *Canhamiana* var. (*C. Mossiae Wageneri* × *L. purpurata alba*)* G.H.
Laeliocattleya × *Chantinii* var. (*C.* × *Hardyana* × *L. C.* × *elegans Sibyl*)* G.H.
Laeliocattleya × *Clonia* var. (*C. Warscewiczii* × *L. C.* × *elegans Schilleriana*)* G.H.
Laeliocattleya × *Constance* (*L. C.* × *Bletchleyensis* × *C. Mossiae*)* G.H.
Laeliocattleya × *D. S. Brown* (*C. Trianae* × *L. C.* × *elegans*)* G.H.
Laeliocattleya × *D. S. Brown* var. *Martinetii* (*C. Trianae* × *L. C.* × *elegans*)* G.H.
Laeliocattleya × *Dora* (*C. Schroederae* × *L. C.* × *Hippolyta*)* G.H.
Laeliocattleya × *elegans* (*C. Leopoldi* × *L. purpurata*) N.H.
Laeliocattleya × *elegans* var. *Turneri* (*C. Leopoldi* × *L. purpurata*)* N.H.
Laeliocattleya × *Empress of Russia?** G.H.
Laeliocattleya × *Eva* (*C. Gaskelliana* × *L. tenebrosa*) G.H.
Laeliocattleya × *exoniensis* (*C. Mossiae* × *L. crispa*)* G.H.
Laeliocattleya × *Fascinator* (*C. Schroederae* × *L. purpurata*) G.H.
Laeliocattleya × *Fascinator* var. (*C. Schroederae alba* × *Laelia purpurata*)* G.H.
Laeliocattleya × *Fournierae* (*C. Dowiana* × *L. C.* × *elegans* ♀) G.H.
Laeliocattleya × *Gottoiana* (*C. Warneri* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Greenwoodii* (*C.* × *Hardyana* × *L. C.* × *Schilleriana* ♀)* G.H.
Laeliocattleya × *Hildegard* (*C. Warscewiczii* × *L. C.* × *Decia*)* G.H.
Laeliocattleya × hybrid (*L. C.* × *Bletchleyensis* × *C. Gaskelliana*)* G.H.
Laeliocattleya × hybrid (*C.* × *Hardyana* × *L. C.* × *Greenwoodii*)* G.H.
Laeliocattleya × hybrid (*C. gigas* × *L. C.* × *Greenwoodii*)* G.H.
Laeliocattleya × hybrid (*C. gigas* × *L. C.* × *Endymion*)* G.H.
Laeliocattleya × hybrid (*C.* × *Hardyana* × *L. C.* × *Greenwoodii*)* G.H.
Laeliocattleya × hybrid (*C. Gaskelliana* × *L. C.* × *Bletchleyensis*)* G.H.
Laeliocattleya × hybrid (*C. Warscewiczii* × *L. C.* × *Endymion*)* G.H.
Laeliocattleya × hybrid (*C. Warscewiczii* × *L. C.* × *Greenwoodii*)* G.H.

* Gift of D. S. Brown.

Laeliocattleya × *Hyeana* (*C. Lawrenceana* × *L. purpurata* ♀)* G.H.
Laeliocattleya × *Ingrami* (*C. Dowiana* × *L. Dayana*)* G.H.
Laeliocattleya × *Jeanette* (*C. labiata* × *L. C.* × *Gottoiana*)* G.H.
Laeliocattleya × *Kathleen* (*L. C.* × *Canhamiana* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Leoniae* (*C. labiata* × *L. C.* × *exoniensis*)* G.H.
Laeliocattleya × *Lucasiana* (*C. labiata* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Lycidas* (*C. Schroederae* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Mabel* (*C. Trianae* ♀ × *L. tenebrosa*)* G.H.
Laeliocattleya × *Marquis de Wavrin* var. (*L. C.* × *elegans Turneri* × *C.* × *Hardyana*)* G.H.
Laeliocattleya × *Marquis de Wavrin* var. (*L. C.* × *elegans Sibyl* × *C.* × *Hardyana*)* G.H.
Laeliocattleya × *Martinetii* (*C. Mossiae* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Martinetii* var. (*L. tenebrosa* × *C. Mossiae Wageneri*)* G.H.
Laeliocattleya × *Massangeana* (*C. Schilleriana* × *L. tenebrosa*)* G.H.
Laeliocattleya × *Memnon* (*C. Mendelii* × *L. C.* × *elegans*)* G.H.
Laeliocattleya × *Minnie* (*C. Dowiana* × *L. C.* × *exoniensis*)* G.H.
Laeliocattleya × *Nysa* (*L. crispa* × *C. Warscewiczii*)* G.H.
Laeliocattleya × *Pallas* (*C. Dowiana* × *L. crispa*)* G.H.
Laeliocattleya × *Purple Emperor* (*C. Warscewiczii* × *L. C.* × *callistoglossa*)* G.H.
Laeliocattleya × *purpurato-Rex* (*L. C.* × *Canhamiana Rex* × *L. purpurata*)* G.H.
Laeliocattleya × *Wellesleyi* (*C. Warscewiczii* × *L. C.* × *Martinetii*)* G.H.
Laeliocattleya × *Woodhamii* (*C.* × *Hardyana* × *L. purpurata*)* G.H.
Laeliocattleya × *Zoroaster* (*L.* × *Latona* × *L. C.* × *Canhamiana*)* G.H.
Leptotes bicolor
Lockhartia pallida
*Lycaste sp.**
Lycaste aromatica
Lycaste cruenta
Lycaste cruenta var. *majus**
Lycaste Deppei
Lycaste lasioglossa
*Lycaste Skinneri**
Lycaste Skinneri var. *alba**

Masdevallia bella
Masdevallia muscosa
Maxillaria sp.
Maxillaria crassifolia
*Maxillaria luteo-alba**
Maxillaria nasalis
Maxillaria picta
Maxillaria tenuifolia
Maxillaria valenzuelaria?
Maxillaria variabilis
Maxillaria variabilis var. *lutea*
Maxillaria Yanaperiensis
Megaclinium sp.
Megaclinium colubrinum
Miltonia sp.
Miltonia candida
Miltonia Clowesii
Miltonia Cogniauxiae var. *bicolor*
Miltonia flavescens
Miltonia Roezlii
Miltonia Roezlii var. *alba*
Miltonia spectabilis
*Miltonia vexillaria**
Mystacidium infundibulare

Nanodes Matheosii
Neobenthamia gracilis

Odontoglossum citrosmum
Odontoglossum × *Clytie* (*O. Edwardii* × *Pescatorei*)
*Odontoglossum grande**
Odontoglossum pulchellum var. *majus*
Odontoglossum Reichenheimii
Oncidium sp.
Oncidium ampliatum
Oncidium ampliatum var. *majus*
Oncidium barbatum var. *limbatum?*
Oncidium carthaginense
Oncidium Cavendishianum

* Gift of D. S. Brown.

Oncidium Cebolleta
Oncidium crispum
Oncidium divaricatum
Oncidium flexuosum
Oncidium Geertianum
Oncidium Kramerianum
Oncidium Lanceanum
Oncidium leucochilum
Oncidium luridum
*Oncidium Marshallianum**
Oncidium microchilum
Oncidium ornithorhynchum
Oncidium Papilio
Oncidium phymatochilum
Oncidium pumilum
Oncidium Retmeyerianum
Oncidium rupestre
Oncidium Schlimii
Oncidium sphacelatum
Oncidium splendidum
Oncidium stipitatum
Oncidium varicosum var. *Rogersii*
Oncidium Wentworthianum
Ornithidium sp.
Ornithidium densum
Ornithidium sophronitis

Peristeria elata
Phaius grandifolius
Phalaenopsis amabilis
Phalaenopsis Cornu-cervi
Phalaenopsis Esmeralda
Phalaenopsis grandiflora
Phalaenopsis Lueddemanniana
Phalaenopsis Regnieriana
*Phalaenopsis Rimestadtiana**
*Phalaenopsis Schilleriana**
Pholidota chinensis
Platyclinis Cobbiana
*Platyclinis filiformis**
Platyclinis glumacea
Platyclinis latifolia
Pleurothallis sp.
Pleurothallis Grobyi
Pleurothallis longissima
Pleurothallis peduncularis
Pleurothallis Pernambucensis
Pleurothallis platyrachis
Pleurothallis tribuloides
Pleurothallis villosa
Polystachya sp.
Polystachya affinis
Polystachya laxiflora
Polystachya leonensis
Polystachya lineata
Polystachya minutiflora
Ponera sp.
Ponera amethystina

Renanthera coccinea
Renanthera Imschootiana
Rhynchostylis violacea
Restrepia sp.

Saccolabium Blumei var. *majus*
Saccolabium giganteum
Saccolabium guttatum
*Saccolabium praemorsum**
Sarcanthus laxus
Sarcanthus Williamsonī
Sarcochilus Hartmani
Sarcochilus unguiculatus
Scaphyglottis sp.
Scaphyglottis prolifera
Schomburgkia sp.
Schomburgkia tibicinis
Schomburgkia undulata
Sigmatostalix radicans
Sobralia sp.
Sobralia dellense (*leucoxantha* × *Lowii*) G.H.
Sobralia macrantha
Sobralia macrantha var. *albida*
Sobralia Warocqueana?
Sophrocattleya × *Chamberlainii* (*C. Harrisoniana* × *S. grandiflora*)* G.H.
Sophrocattleya × *Thwaitesii* (*C. Mendelii* × *S. grandiflora*)* G.H.
Sophrolaelia × *Gratrixiae* (*L. tenebrosa* × *S. grandiflora*)* G.H.
Spathoglottis × *aureo-Vieillardii* (*S. aurea* × *S. Vieillardii*) G.H.
Spiranthes grandiflora
Stanhopea sp.
Stanhopea sp. (large red spots)*
*Stanhopea Amesiana**
*Stanhopea concolor**
Stanhopea × *Devoniensis* (*S. insignis* × *S. tigrina*) N.H.
Stanhopea eburnea var. *spectabilis*
Stanhopea insignis
Stanhopea oculata
Stanhopea (*Rita*)*
Stanhopea tigrina
Stanhopea tigrina var. *splendens**
Stanhopea Wardii
Stauropsis giganteus
Stauropsis lissochiloides
Stelis sp.
Stelis aurea var. *purpurea?*
Stelis ciliaris
Stelis ophioglossoides
Stelis smaragdina

* Gift of D. S. Brown.

Stenoglottis longifolia

Tainia penangiana
Tainia viridi-fusca
Thrixspermum lilacinum
Thunia alba
Trichocentrum fuscum
Trichopilia sp.
Trichopilia hymenantha
Trichopilia suavis
Trigonidium obtusum

Vanda sp.
Vanda Bensonii
Vanda Boxallii
Vanda coerulea
*Vanda gigantea**
Vanda lamellata
Vanda limbata
*Vanda Niemanii**
Vanda Parishii
Vanda Parishii var. *Mariottiana*
Vanda Sanderiana
*Vanda suavis**
Vanda suavis var. *Rollisoni*
Vanda suavis var. *superba**
*Vanda teres**
Vanda teres var. *alba**
Vanda teres var. *Andersoni*
Vanda × *Joaquiniae* (*V. Hookeriana* × *V. teres*) G.H.
Vanda tricolor

Vanilla sp.
Vanilla Humbolotii
Vanilla Portacei

Xylobium concavum
Xylobium hyacinthina
Xylobium squalens

*Zygopetalum Mackaii**

WINTER INJURY TO PLANTS IN THE GARDEN

The extreme severity of the winter 1917–18 has caused a great deal of injury and in some cases death to the woody plants at the Garden which under ordinary conditions survive the cold successfully. The rather unusual abundance of snow, however, was instrumental in protecting the roots of the woody and particularly the herbaceous plants, so that the latter suffered much less than might have been expected from the unusual season. The abnormal conditions have served a useful purpose in indicating the thorough hardiness of certain planting material as well as the need of substitution for the more tender plants.

The killing back to the ground of most of the California privet (*Ligustrum ovalifolium*)—the plant almost universally used for hedges in St. Louis—was surely an impressive demonstration of the necessity for a substitute for this favorite. Fortunately, Amoor privet (*Ligustrum amurense*) is hardy, easily clipped, and fully as effective, and should be used in place of the California variety. The Japanese barberry (*Berberis Thunbergii*) may also be successfully substituted.

The roses, as a whole, have suffered more damage than any of the other plants. In exposed locations the usually hardy climbers have been killed back to the ground, with the exception of *Rosa Hugonis,* "Crimson Rambler," "Kalmia," and a few others. Despite the thorough protection given the standard tree roses, the hybrid perpetual and

* Gift of D. S. Brown.

hybrid tea types were all winter killed, only the rambler type surviving ("Lady Gay"). The usual protection of 10–12 inches of soil around each plant, as well as an additional mulch of manure, failed to save many of the teas and hybrid teas, particularly such yellow and orange varieties as "Mrs. Aaron Ward," "Duchess of Wellington," "Madame Ravary," "Melanie Soupert," "Sunburst," and "Harry Kirk." And even more hardy varieties were killed to the ground, including the popular "Gruss an Teplitz," which has always been considered extremely resistant to cold. The hybrid perpetuals wintered without injury, being killed back to about where they would naturally be pruned in the spring. The polyanthas and the Bourbons also survived, though severe pruning was required to remove all the dead wood. Among the *rugosa* types the usually hardy "Conrad F. Meyer" was killed to the ground, while *Rosa rugosa alba* suffered somewhat lesser injuries. The type *R. rugosa,* as well as *R. blanda, R. setigera, R. multiflora,* etc., showed no deleterious effects of the winter.

The evergreens, as a group, suffered severely, due to the combination of extreme cold and accompanying increase of coal gases in the atmosphere. The arborvitaes (Thuya), junipers (Juniperus), hemlocks (Tsuga), and *Pinus montana* sustained the greatest injuries.

Among the broad-leaved trees *Magnolia grandiflora* (bull magnolia) and *Broussonetia papyrifera* (paper mulberry) were affected quite seriously. The specimens of *Magnolia grandiflora,* newly set out, despite a heavy protection of straw and burlap, showed a complete death of branches, the trunk itself, however, containing sufficient life to push out adventitious buds which may ultimately result in establishing the trees. The fact that they were not thoroughly acclimated before the coming of such a severe winter is probably responsible for the great injury. *Broussonetia papyrifera* trees were killed half way to the ground, necessitating severe pruning. White birch (*Betula alba*) and *Paulownia tomentosa* have died back, forming misshapen specimens.

The following table indicates the shrubs affected and the extent of the injury:

Botanical Name	Common Name	Injury
Amorpha fruticosa	False indigo	Half way killed
Aralia spinosa	Hercules club	Slight
Callicarpa purpurea	French mulberry	Dead
Calycanthus floridus	Allspice	Slight
Cephalanthus occidentalis	Button bush	Slight
Deutzia scabra		Killed to ground

Botanical Name	Common Name	Injury
Elaeagnus longipes	Gumi	Partly killed
Forsythia viridissima	Golden bell	Killed to ground
Hibiscus syriacus	Rose of Sharon	Half way killed
Ligustrum ovalifolium	California privet	Killed to ground
Stephanandra flexuosa		Killed to ground
Tamarix africana	Tamarisk	Half way killed
Tamarix gallica	Tamarisk	Killed to ground
Vitex Agnus-castus	Chaste tree	Dead
Zanthoxylum americanum	Prickly ash	Slight
Zanthoxylum clava-Herculis	Toothache tree	Half way killed

Among the newer introductions from Asia the following have proved hardy:

Acanthopanax ricinifolius
Aesculus Bushii
Aesculus "E. G. Palmer"
Aesculus splendens
Ailanthus Duclauxii
Ailanthus Vilmoriniana
Buddleia japonica
Caragana arborescens pendula
Cornus brachypoda
Cornus controversa
Corylus heterophylla
Diervilla japonica
Hamamelis japonica
Hamamelis vernalis
Hypericum Kalmianum
Indigofera Kirilowii
Juglans rupestris
Physocarpus opulifolius inebrians
Populus angustifolia
Populus balsamifera × *deltoides*
Populus suaveolens
Populus tomentosa
Prinsepia uniflora
Pyrus Michauxii
Pyrus serotina
Sorbaria arborea
Spiraea Veitchii
Spiraea Wilsonii
Syringa Josikaea
Syringa reflexa
Syringa Sweginzowii
Syringa tomentella
Ulmus glabra Wheatleyi
Ulmus parvifolia
Viburnum Opulus xanthocarpum
Viburnum Sargentii

NOTES

Mr. F. C. Harris, student in the School for Gardening, has been drafted in the National Army.

Hon. Joseph Richmond Churchill, of Boston, Mass., spent a part of May in the herbarium and library.

Mr. Clarence Pedlow, former student in the School for Gardening, has been appointed Assistant Superintendent of School Gardens of St. Louis.

Mr. R. A. Studhalter, formerly Lackland Fellow, has entered the Naval Reserve Corps, Mare Island, San Francisco. as Hospital Assistant, first class.

Mr. Alexander Lurie, Horticulturist to the Garden, led a "round table" discussion on gardening at the Webster Groves Gymnastic Association, on May 2.

Mr. Charles W. Fullgraf, former student in the School for Gardening, has received the commission of First Lieutenant in the United States Quartermaster Department.

M. Takenouchi, Assistant Professor of Bacteriology, University of Tokyo, visited the Garden May 14, with a view to arranging for some special investigations in the fall.

STATISTICAL INFORMATION FOR APRIL, 1918

GARDEN ATTENDANCE:

Total number of visitors	23,826

PLANT ACCESSIONS:

Total number of packets of seed received in exchange	18
Total number of plants and seed received as gifts	142

PLANT DISTRIBUTION:

Total number of plants and seed distributed in exchange	94

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	17
Total number of books and pamphlets donated	118

HERBARIUM ACCESSIONS:

By Purchase—	
Canton Christian College—Plants of China	762
A. A. Heller—Plants of California	300
By Exchange—	
Bureau of Science, Manila, by E. D. Merrill—Plants of the Philippine Islands	359
Iowa State College, by L. H. Pammel—Plants of Iowa and Wyoming	51
J. R. Wier—Fungi of northwestern United States	274
By Gift—	
Oakes Ames—*Isoetes saccharata* var. *Amesii* Eaton	1
J. A. Drushel—Plants of the central and western United States	14
TOTAL	1,761

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director,

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

ANNE W. DAVIS,
Research Assistant.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI JUNE, 1918 No. 6

CONTENTS

	Page
The Chewing Gum Tree	73
Dasylirion serratifolium	74
Pothos celatocaulis	74
Bird of Paradise Plant	74
Dracaena glomerata and Dracaena kindtiana	75
The Banyan Tree	76
Growth of Palms	77
Effect of the War at the Garden	77
Notice	78
Notes	78
Statistical Information	80

ST. LOUIS, MO.
1918

Published Monthly Except July and August by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President.

EDWARDS WHITAKER.

Vice-President.

DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL,
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary

THE CHEWING GUM TREE.

(ACHRAS SAPOTA.)

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., June, 1918 No. 6

THE CHEWING GUM TREE

One of the plants in the economic house which always attracts the attention of children as well as some older people, is the sapodilla, or chewing gum tree (*Achras Sapota*). It is a native of tropical America and the West Indies and is generally cultivated in the tropics. The wood, called by the natives "the wood of eternal life," is very hard, with a perfectly straight grain, and is used for rafters in buildings, and the fruit, which resembles the persimmon both before and after it is ripe, is much relished. But it is the dried milky juice of the sapodilla tree which makes it of so much commercial importance. This juice, known locally as "chicle" (the native word for juice, now universally applied to the product of the sapodilla), is collected during the rainy season, when it flows most freely. The native laborer makes a series of v-shaped incisions in the bark, being careful not to cut too deeply, and the milk-like juice flows into a canvas bag or other receptacle at the base of the tree. Contact with the air speedily thickens it as well as changing it to a deep yellow hue. The thickened juice is collected daily and removed to camp, where it is boiled and kneaded to remove the superflous moisture. By this time it is like fresh taffy and gray in color and is ready to be molded into square blocks for shipment.

The raw product is imported into this country from Mexico, British Honduras, Venezuela, Central America, and Canada, the latter being supplied from certain British possessions. After the chicle reaches the manufacturer it is first chopped into fine particles, then dried, and finally boiled down in vacuum pans to further purify it and remove any natural moisture. Sweetening and flavoring ingredients having been added, the dough is kneaded, rolled, cut into strips, and wrapped in the regulation manner. All these operations are accomplished by machinery. While originally the natural gums of spruce, sweet gum, tamarack, peach, and other trees were resorted to for the basis of chew-

ing gum, and later paraffin was used, chicle seems to be the most satisfactory and has practically replaced all other materials in the making of this popular confection. The chewing gum industry of the United States has grown to such proportions in the last decade that it now exceeds each year by several millions of dollars the value of all synthetic chemicals, dyestuffs included, imported annually before the war.

DASYLIRION SERRATIFOLIUM

For tropical ornamentation *Dasylirion serratifolium,* a native of southeastern Mexico, is equal in many respects to the commonly used *Yucca filamentosa* except that it does not possess quite the same degree of hardiness. Dasylirion forms dense heads of glaucous leaves measuring 2–3 feet in length with prominently serrate, prickly margins.

After having been transplanted into the succulent house from the old yucca dome, where it was annoying to all passers-by on account of the prickly leaves spreading out above the walk, it flowered for the first time in twenty years. The flower spike was 15 feet high, formed like a fox tail, with hundreds of small yellow flowers attached to the parent stem upon small racemes, resembling somewhat the goldenrod.

POTHOS CELATOCAULIS

The shingle plant (*Pothos celatocaulis*) is a tropical American climber commonly used in greenhouses as a wall covering. It fastens itself to the wall by means of hairy protuberances radiating from the stem, the leaves being imbricated in the form of shingles.

As soon as the plant outgrows its support, large-lobed leaves are produced and at the same time thick roots are sent out, penetrating the ground. In this stage it is often mistaken for *Philodendron pinnatifidum* with its large-lobed foliage. The photograph illustrates the stages from the entire to pinnatifid formation and the reverse.

BIRD OF PARADISE PLANT

The bird of paradise plant is so called because of the brilliant and unusual color combination of its flower stalk. Botanically it is known as *Strelitzia augusta,* the genus being named in honor of Queen Charlotte of the Mecklenburg-Strelitz family, and wife of George III. This plant belongs to the banana family (Musaceae) and includes six species

DASYLIRION SERRATIFOLIUM.

POTHOS CELATOCAULIS.

DRACAENA KINDTIANA.

native of Africa, the Garden collection being represented by three species.

Strelitzia augusta is the largest-growing type of the genus, forming a woody trunk with numerous suckers and fan-shaped leaves attaining a height of 20–25 feet. In general habit it strongly resembles the "travelers' tree" of Madagascar especially in the fan formation of the leaf stalks, and is like the common banana in the large flat leaves which often measure 3–4 feet in length. These split readily to the central stalk, giving the same ragged appearance as the banana when subjected to the action of winds.

The large specimen on the west side of the palm house has been in the collection for fifteen years. Previous to its removal to the palm house, it was grown in a tub under crowded conditions in the old greenhouses. However, since being placed under more natural conditions, a considerable growth has been attained, its first flowers having finally been produced. The formation of the flowers is unusual; they are enclosed in a large dark purple bract which emerges from the base of the imbricated leaf stalk. When fully matured the single flowers have to force their way through the apical portion nearest the trunk. New flowers appear every two or three days, pushing the preceding ones back. The petals are pure white with a beak-like lip of pleasing dark blue color. During its present blooming period it has produced two spikes with over twenty flowers. Propagation is accomplished by suckers or seeds.

DRACAENA GLOMERATA AND DRACAENA KINDTIANA

During the World's Fair at St. Louis in 1904, arrangements were made with Mr. Verner, who brought the South African pygmies for exhibition, to collect rare plants for the Garden. In 1906 a consignment of rare plants was received, including two very rare dracaenas, *D. glomerata* and *D. Kindtiana*, at that time the only specimens of these varieties in any botanical collection of the world. Sometime later, however, the Laurente expedition collected these same varieties.

Dracaena glomerata is the more ornamental of the two, resembling in habit *D. Goldieana*, although the growth is more vigorous. The leaves are ovate-lanceolate, light green, sparsely mottled with lighter green. The flowers are white. At the St. Louis Spring Flower Show in 1917 the Society of American Florists silver medal was awarded to this new introduction. *D. Kindtiana* grows to a height of 2–3 feet

with lanceolate, acuminate, dark green, furrowed leaves, produced in fan formation. Its peculiarity of growth, rather than ornamental value, makes it of particular interest. The abundance of white, strongly scented flowers produces a pleasing effect during certain seasons.

THE BANYAN TREE

The banyan tree (*Ficus benghalensis*), a small specimen of which is to be found at the west end of the varied industries house, is a tropical tree of India, chiefly noteworthy because of its columnar roots. Closely related to this species is the celebrated Asrhatta, sacred fig tree of the Hindus, under which Buddha is said to have gained his wisdom.

As the banyan grows upward and outward the branches are supported by aerial roots, resulting from seed germinating while still on the topmost leaves, which reach to the ground and take root. These columnar roots extend in diameter, producing branches and other lateral roots, the entire structure acting not only as a support but assuming the function of absorption and distribution of food as well. The trees grow to such an immense spread that it is claimed that an army of 5,000 men once encamped beneath the shade of one, while the village of Dina Pitza, Ceylon, with its hundred huts, stands under the crown of another. It is only through care and cultivation by the natives, who consider the tree sacred, that such size is attained. Ordinarily the ground under the tree is so hard, due to the dense foliage, that the aerial roots cannot penetrate it without aid from the natives, which is furnished by encasing the roots in bamboo tubes and sinking them in the ground. Usually the columnar roots are not developed in greenhouses, but the Missouri Botanical Garden is fortunate in having one specimen showing a large aerial root which started at a height of about 4 feet and, after twining itself around the main stem, entered the ground.

The tree yields an inferior grade of rubber containing 12.4 per cent caoutchouc and 82.2 per cent resin. It is employed in Lahore in the oxidation of copper. For medicinal purposes the juice is applied externally for bruises and as an anodyne in rheumatism. An infusion of the bark is regarded as a powerful tonic in the treatment of diabetes, while the leaves are heated and used as a poultice. The fruits, leaves, and young shoots are used as food by the natives as well as fodder for their cattle.

DRACAENA GLOMERATA.

BIRD OF PARADISE PLANT.
(STRELITZIA AUGUSTA.)

THE BANYAN TREE.

(FICUS BENGHALENSIS.)

GROWTH OF PALMS

The determination of the age of palms grown under greenhouse conditions is a matter of considerable interest, but very little data is available for comparative study. Certain palms, like *Oreodoxa regia,* indicate their rate of growth by the permanent leaf scars upon the trunk, while others, like Livistona, Cocos, Phoenix, etc., have a tendency to lose their leaf blades, leaving no scars, thus making age determination impossible with any degree of accuracy.

The following list indicates the study of growth in the palm house at the Garden during a period of one year. It is interesting to note that almost invariably the greatest growth has taken place during the summer months, indicating partial dormancy during the winter.

NUMBER OF LEAVES DEVELOPING

Name	Jan.	Mar.	July	Sept.	Dec.	Total
Acanthorhiza aculeata	1	2	3	4	3	13
Archontophoenix Cunninghamii	1	0	1	2	2	6
Arenga saccharifera	1	1	1	0	1	4
Astrocaryum mexicanum	1	1	2	2	2	8
Ceroxylon andicolum	1	1	1	1	1	5
Chamaedorea sp.	1	1	1	1	1	5
Chamaerops humilis	3	4	8	9	4	28
Chrysalidocarpus lutescens	1	1	1	1	1	5
Cocos flexuosa	1	1	1	1	1	5
Elaeis guineensis	1	1	1	2	1	6
Erythea armata	2	2	2	2	1	9
Howea Belmoreana	1	1	1	1	2	6
Licuala grandis	1	1	1	2	0	5
Livistona australis	1	2	5	6	4	18
Livistona chinensis	1	1	2	4	2	10
Martinezia caryotaefolia	1	1	1	2	1	6
Oreodoxa regia	1	1	1	1	1	5
Phoenix dactylifera	3	3	5	9	5	25
Phoenix reclinata	3	3	4	5	4	19
Phoenix Roebelenii	2	2	3	10	7	24
Ptychosperma Macarthuri	1	1	1	1	2	6
Pritchardia Martii	1	1	3	2	2	9
Rhapis flabelliformis	1	3	3	2	2	11
Sabal glaucescens	1	1	0	1	1	4
Sabal Palmetto	1	1	1	2	1	6
Thrinax argentea	1	1	2	1	2	7
Trachycarpus excelsa Fortunei	2	3	4	4	4	17
Washingtonia filifera	1	3	5	4	2	15
TOTAL	37	44	64	82	60	287

EFFECT OF THE WAR AT THE GARDEN

The order of the Fuel Administrator, reducing by 50 per cent the amount of coal available for florists has been interpreted as applying to institutions like the Garden as well

as commercial concerns. Special permission has been obtained from Washington allowing the Garden to use sufficient coal to maintain its various permanent collections of tropical plants, but it will be necessary to cut off all the propagating houses back of the wall in order that as much coal as possible may be saved. This will prevent growing a large number of the plants used in the winter floral displays and likewise make it impracticable to grow the bedding plants used in the outdoor gardens during the spring and summer months. Consequently the Garden will probably present a very different appearance next summer, since many of the beds will have to be either left unplanted or used for growing vegetables or other annuals which can be started from seed out of doors. Since it will require no heat to bring the chrysanthemums to their usual perfection, the regular chrysanthemum exhibit will be made next fall, but after this show the displays will be confined to blooming orchids, azaleas, and other perennial material.

NOTICE

For various reasons it seems desirable to discontinue the publication of the BULLETIN during the months of July and August. Consequently the next number of the BULLETIN will not appear until the end of September. The total number of pages for the current volume will not be materially reduced and the regular contents will appear in ten numbers instead of twelve.

NOTES

Dr. Charles Thom, of the United States Bureau of Chemistry, was a recent visitor at the Garden.

Dr. I. E. Melhus, of the Iowa Agricultural Experiment Station, spent June 14 and 15 at the Garden consulting the library and mycological herbarium.

Miss Anne W. Davis, of Princeton, New Jersey, research assistant in the graduate laboratory, has resigned to engage in chemical work relating to the war.

Dr. M. Kanda, professor of botany in the Hiroshima Higher Normal School, Japan, accompanied by a group of his countrymen, visited the Garden on June 11.

The following have been appointed Teaching Fellows in the Shaw School of Botany, Washington University, and will register for work in the graduate laboratory:

Miss Joanne L. Karrer, Puyallup, Washington; B. S. University of Washington, 1915; M. S. University of Washington, 1916.

Mrs. Adele L. Grant, Columbia, California; B. S. University of California, 1902.

Volume V, Number 2, of the Annals of the Missouri Botanical Garden has appeared during the month, with the following contents:

"Correlation of the Strength and Durability of Southern Pine," S. M. Zeller.

"Corticiums Causing Pellicularia Disease of the Coffee Plant, Hypochnose of Pomaceous Fruits, and Rhizoctonia Disease," E. A. Burt.

"Gautieria in North America," S. M. Zeller and C. W. Dodge.

"Notes on Certain Cruciferae," E. B. Payson.

"The Effect of Bordeaux Mixture on the Rate of Transpiration," B. M. Duggar and W. W. Bonns.

STATISTICAL INFORMATION FOR MAY, 1918

GARDEN ATTENDANCE:

Total number of visitors 20,202

PLANT ACCESSIONS:

Total number of packets of seeds received in exchange 47

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought 9
Total number of books and pamphlets donated 297

HERBARIUM ACCESSIONS:

By Purchase —

T. S. Brandegee — Plants of Mexico, collected by C. A. Purpus 232
Walter Fischer—Plants of Argentina 283
Dr. C. S. Sargent—Plants of the Philippine Islands, collected by Aduro and Sabiarya 486

By Gift —

Hon. Joseph Richmond Churchill—Plants of Massachusetts.. 124
Dr. G. P. Clinton—*Coniophora hyssoidea* on stems of seedling of *Picea excelsa* just imported from France 1
Dr. W. G. Farlow — Hydnaceous fungi from Maine, New Hampshire, Massachusetts, and Florida 72
Prof. H. M. Jennison—*Pleurotus ulmarius* and *P. ostreatus* from Montana 2
C. D. Learn—*Pyrus iocnsis* (Wood) Bailey and *Centaurea americana* Nutt. from Oklahoma 2
Dr. W. H. Long—Wood-destroying fungi mostly from New Mexico 7
Philip C. Scanlan—*Ellisia Nyctelea* L. from Illinois 1
Shenandoah Nurseries—Cultivated specimen of *Elaeagnus sp.* from Muskogee, Okla 1

By Exchange —

U. S. National Museum—Plants of the United States 330

TOTAL 1,541

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2.00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

JOHN NOYES,
Landscape Designer.

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI SEPTEMBER, 1918 No. 7

CONTENTS

	Page
Henry Shaw's Contribution to Art in St. Louis	81
Hybrid Nymphaeas	90
Notes	94
Statistical Information	96

ST. LOUIS, MO.
1918
Published Monthly Except July and August by the Board of Trustees

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL,
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

RICHARD MURPHY,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary

TOMB OF HENRY SHAW IN THE GARDEN.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., September, 1918 No. 7

HENRY SHAW'S CONTRIBUTIONS TO ART IN ST. LOUIS

Although Henry Shaw is rightly regarded as one of the greatest benefactors of the city of his adoption, this idea is based primarily, if not entirely, upon his founding of The Missouri Botanical Garden and his gift to St. Louis of Tower Grove Park. Still another aspect of his generosity and desire to give pleasure to his fellow townsmen, which is not so generally recognized, was his effort to provide objects of art, in the form of statues and busts, which were worthy of the men thus commemorated.

As early as 1878 he presented to the city two bronze statues, which at that time were among the most noteworthy pieces of this character in the United States. These gifts were followed by others until, at the time of his death, eleven years later, he had made available to the public another bronze statue, three marble statues, and nine marble busts, all executed in the best artistic manner of the period.

In order that a permanent record may be made of some of the little-known facts concerning these various gifts, it has seemed advisable to bring together in the BULLETIN an account of the circumstances associated with Mr. Shaw's efforts to provide for St. Louis suitable examples of the sculptor's art. The sources of the information here embodied are the newspapers of the day, a review of the origin and history of Tower Grove Park, by David H. MacAdam, prepared by order of the Board of Commissioners in 1883, and, most important of all, certain letters from the sculptors themselves, which it is believed contain facts of interest not hitherto made public.

The first statue presented to the city by Mr. Shaw was that of Shakespeare, which was unveiled on April 23, 1878, the 314th anniversary of the poet's birth. The event was marked by unusual simplicity. Mr. Shaw, in the fewest possible words, formally presented the statue and acting-

Mayor Lightner accepted it for the citizens of St. Louis. Some impromptu remarks by Capt. James McDonough followed, and a party of Mr. Shaw's friends then proceeded to his residence in the Garden, where a reception was held.

The statue was designed and executed in bronze by Ferdinand Miller,* of Munich, afterwards Baron von Miller, who was later elected first president of the International Exhibition of Art and was apparently recommended to Mr. Shaw by Mr. George I. Barnett, the architect who designed the pedestal and base.

On November 24, 1878, the second bronze statue, namely, that of Humboldt, was unveiled in Tower Grove Park. Mr. Shaw was ill at the time and not able to be present, but the occasion was a much more festive and elaborate one than that of the presentation of the Shakespeare monument. The ceremonies were in the hands of the German-American societies of St. Louis, and a procession consisting of various Turnverein, Maennerchor, and Saengerbund organizations, together with school children and two bands, marched through the park before assembling at the site of the statue. Mr. Preetorius acted as chairman, and the program consisted of music, an address in German by Mr. Carl Luedeking, the acceptance of the statue for the citizens of St. Louis by Mayor Overstolz, and remarks by Professor W. T. Harris.

This statue was executed by the same sculptor and the pedestal by the same architect who had furnished the Shakespeare statue, and the cost of each statue was apparently the same, namely, $5,000, delivered in St. Louis, not including the pedestal or setting up.

Additional artistic features were added to the park on Sunday afternoon, July 16, 1882, when the marble busts of Mozart and Rossini were presented by Mr. Shaw. These were the work of Howard Kretschmar, a St. Louis sculptor. The St. Louis Grand Orchestra rendered several selections from Mozart, and, after the unveiling by Miss Lena Anton, a pianist of St. Louis, Mr. Shaw in a few simple words presented the busts to the city. Judge J. Gabriel Woerner delivered an appropriate address and the ceremony concluded with music by the orchestra and the Liederkranz. Postlewaithe's band gave a concert for the remainder of the afternoon.

---

* This spelling of the name, instead of Mueller which has appeared in print at various times, is in accordance with the signature of the letters of the sculptor.

STATUE OF SHAKESPEARE IN TOWER GROVE PARK.

STATUE OF HUMBOLDT IN TOWER GROVE PARK.

That Mr. Shaw had long had in mind the presentation of a statue of Columbus is shown by a letter from Miller, as far back as 1878, who wrote: "I was always afraid you would not enjoy the statue of Humboldt because your wish had been to erect a monument to Columbus," and at another time: "I surely admit that the enthusiasm would have been still greater for Columbus, as any man that lives in America must have for him great interest, but it would not have been possible to change it with all my best will." Apparently, after the statue of Humboldt was in progress, Mr. Shaw had contemplated having it changed to one of Columbus.

The following extracts from letters* of Ferdinand Miller add greatly to the interest of the Columbus statue as it stands in the park, since they throw much light upon the conception of the discoverer which the artist tried to carry out. They also demonstrate that Mr. Shaw had very definite ideas of what he wanted and that his part in the development of the statue was by no means a small one.

"Munich, March 9, 1883.

" *

"The pedestal for Columbus I get drawn just now and I hope you will agree with it. Respective to your conceiving of Columbus I shall fulfil your wishes but shall at all events make first a sketch of it which I will send you. Concerning the relievoes, you wanted upon one side Piloty's picture and upon the other the design which you suggested. I shall take the drawing you have sent as the main idea but shall make a few alterations and send you a sketch of it. That question, however, is not pressing and can be settled afterwards. Drawings of the pedestal and relievo I'll send you before long. I am just commencing the sketch of the monumental gravestone. I am much obliged to you for the photographs which are very good. I shall also comply with your desires in this case. I would be pleased to know whether you wish me to finish first Columbus or the tombstone?

"If you deem it proper to make a synallagmatic contract I beg you to send me same to sign. I think in the way we did it the last time.

"About the relievo and pedestal I cannot tell you anything as yet; you must first see the drawing. I would like to have the pedestal richer than that of Humboldt and Shakespeare. I suppose you will agree with it."

"Munich, May 5, '83.

"Dear Sir:

"Just now I have received your favor. I sent you a small sketch of Columbus which gives only an approximate idea of the way I picture the statue to myself and how it would look upon the ped-

---

* The letters are written in English and the author frequently expresses his dissatisfaction with the translation. However, it seems best to copy them verbatim.

estal. I am just modeling the sketch. It is a conception which is expressed in Piloty's picture and also the same which I intend to give the figure, but certainly it is not possible to make the same thing in plastic art as in the picture. A figure must be composed for every side and a picture only for one; we therefore have to make some alterations in the posture and the conceiving; however, you needn't feel uneasy as I have understood your intentions and shall act accordingly as much as possible. The drawing of the relievo I have put in the post, it is also only a sketch. Please to send it back and let me know your wishes about it, to enable me to make the alterations according to them.

"Concerning the second relievo our wishes seem to meet. I have written to you that I should like to choose the moment when Columbus takes possession of the country. The pedestal for the grave monument I get drawn, so that they can work after it in America, the measures in English feet."

"Munich, May 24, '83.

"* * * *

STATUE OF COLUMBUS IN TOWER GROVE PARK.

THE LINNEAN HOUSE—SHOWING THE BUSTS OF LINNAEUS, NUTTALL, AND GRAY.

but not as the undaunted sea-farer. Piloty had chosen a different conceiving which I liked much better and when I have expressed the desire of seeing Columbus executed in bronze I meant by this to represent him as the energetic and undaunted sea-farer. If my letter said something else it certainly was the fault of my imperfect translation for I would not have taken the liberty to suggest to you the simple copy of a picture for a statue, as I did not doubt that you wanted an original work for your great idea, in the way as you have chosen an entirely new and original representation for Shakespeare and Humboldt by which you have obtained great applause both in America and in Europe, and particularly in Germany. Since that time I have earnestly studied the question, have read all the works affording sources about the costume of the time and about the person of Columbus, and if my sketch therefore has turned out somewhat different than Piloty's picture which in the first rank is contrived with consideration of the effect of the colors, it anyhow had the same idea for its basis in the way Piloty has first given it in his picture. Piloty himself will confirm that there are other conditions for the plastic execution and if you wish I could easily send you Piloty's own opinion about it, if you attach any importance to it. What I have altered I have only done out of conscientious consideration for all the circumstances. I think I have never ill advised you, and here in Germany at least, where the artists of Munich have unanimously elected me for their president and where at present their confidence has placed me in the rank of the first president of the International Exhibition of Art, people think so much of my judgment that it was certainly not immodest on my part when I thought I should furnish you with an original sketch after my own studies and not with a simple copy.

"But as I said at the beginning of my letter, you may please yourself about it. I shall certainly copy Piloty's picture as well as possible and have only to beg you to inform me at your earliest convenience of your definite opinion to enable me to go on with the work. In the relievo I find the precise copy of Piloty's picture very suitable and very easy to execute; that certainly will turn out to advantage.

"Beethoven is modeled. The photographs I have received, the pedestal looks better than I expected. I am just working at Richard Wagner. As to the expense of the bustoes, I may inform you that I can save by each 50 dollars, consequently I get only 700 dollars for one busto, as I have got by a lucky chance two beautiful marble blocks, each 50 dollars cheaper than I reckoned."

"Reichenhall, Aug. 23, '83.

"* * * * * * * * * * * * * * * * * * * *

Complying with your wish I am to take as a model for Columbus the figure of that one on Piloty's picture, but only on one condition, that I may have as much liberty as possible in the conception of it, that I may alter what is absolutely necessary for a monumental statue. I would rather renounce the execution of the commission if you do not agree to this condition for I will never undertake anything that might not succeed. I esteem more my reputation as an artist than any sum that could be gained in such a way. And at the same time Director Piloty would make a protest against my copying his picture so very accurately. As a relief I shall copy the picture exactly, nothing could be said against that.

"The bust of Beethoven is finished in marble, but if you like I will delay sending it to you until that of Richard Wagner is

finished too. For the latter I made use of a bust which a friend of mine modeled in Venice eight days before Richard Wagner's death and which unfortunately he could not finish, but it is decidedly the very last likeness of that great master.

"I am now beginning to work at Columbus and you and your friends will certainly be contented with it. The design of the pedestal of the sepulchral monument I will forward to you very soon."

"Munich, Apr. 9, '84.

"Dear Sir:

"I am ever so much obliged to you for your favor of the 13th of March and for the remittance of £ 148 s. 17. Indeed I am happy to know that the bustoes have met with your approval. Next week I shall go to Carrara to buy the marble for the grave monument. The expression of the figure I am going to make a little more cheerful. The monument itself has met here with great applause and I hope it will be the same case in America. To tell you the truth, I did not like the idea of sending you the photograph of the monument as it is always sad to see one's self represented in a dead state. But anyhow I thought to have acted according to your notion. The model of Columbus is very near being done and as soon as it is far enough advanced I shall send you a photograph of it.

"I thank you for remembering my parents. They return their compliments to you."

"Munich, May 26, '84.

"I did not return any sooner from Carrara than just now and have found on my arrival your favor of the 29th of March and the remittance of £ 100, equal to 491 dollars gold, which I shall deduct from the costs of the grave monument. I am very much obliged to you for both. The grave monument is commenced in Carrara and will be done in February; the expression of the face will be more cheerful. In the very next time I shall send you the photograph of the relievo of Columbus, that of La Salle will be done a few days afterwards. Please send me the inscription for the plates of the Columbus monument in case you wish any alterations.

"Columbus cannot be finished before the winter, but if you wish the relievoes any sooner than that, they may be done in three months. The head of the statue of Columbus I have made somewhat different than on the relievo, as they found in Madrid a portrait which is taken to be authentic; both the heads, however, bear the same character."

"Munich, November 18, '85.

"Dear Sir:

"I have received your favor of the 31st of October and the photographs of the pedestal on the excellent execution of which I congratulate you.

"To comply with your wish and that of your friends I shall make the execution in bronze with the bearded head, though against my conviction. Here in Munich, however, I shall exhibit Columbus with the beardless head. I am very glad indeed you like the grave monument. You need not be afraid that the bronze will not look well on the pedestal or that it will not be in character with it, as I have tried it here and was very much pleased with the arrangement, the whole looking to great advantage."

"March 8, '86.

"Dear Mr. Shaw:

"Columbus is now so far that I think to be done with the casting in four weeks. Reckoning two weeks for the packing and exhibition, the statue will be ready for transport in the month of May. Please to appoint the time now when you want me to forward the figure. I have been asked from Berlin to exhibit there Columbus at the International Exhibition. I declined as I did not know whether you would like it."

It is to be regretted that Mr. Shaw's letters to Miller are not also available, but the extracts given above are sufficient to indicate how keen an interest he took in the planning and execution of the various works of art presented to the city. He did much more than merely furnish the money for their purchase.

The Columbus statue was unveiled October 12, 1886, the 394th anniversary of the landing of the discoverer of America. As on the occasion of the presentation of the Humboldt statue, the ceremonies were chiefly delegated to the representatives of the nationality of the man to be honored. The Societa di Unione i Fratellanza Italiana, students of Washington University, and others took part in the procession, and the American and Italian flags were prominently displayed. The assembly was called to order by Mr. Joseph Franklin, and the statue unveiled by Miss Sadie MacAdams and Miss Edith Franklin. Mr. Shaw made a most interesting address, going into the history of St. Louis with some detail, and letters were read from distinguished men, among others the historian Bancroft, felicitating Mr. Shaw and the city upon the occasion. Others who spoke were Rev. R. A. Holland, rector of St. George's Church, Prof. Calvin M. Woodward, and Mr. James D. Butler, of Madison, Wisconsin, who is recorded as having made a "humorous address." Mr. F. A. Cafferata and Mr. Moretti represented the Italian societies, the latter speaking in Italian. The statue was accepted for the city by Mayor D. R. Francis.

The marble busts of Linnaeus, Nuttall, and Gray, over the entrance of what in 1883 was the "principal plant house" of the Garden, were dedicated on Friday, June 22, 1883. The members of the American Association of Nurserymen, Florists and Seedsmen, then holding a convention in St. Louis, were present with other guests, by special invitation. The following remarks were made by Mr. Shaw:

"Gentlemen.—I greet you and welcome the horticulturists and florists of America to the Missouri Botanical Garden. On this occasion of your visit, in the briefest possible way, I take the agreeable pleasure of inaugurating the marble busts placed over the

entrance of this newly erected plant house. In the center is Linnaeus, the great reformer of the natural sciences, called by his contemporaries the 'Prince of Nature.' On his right the bust of Thomas Nuttall, designated the 'Father of Western American Botany' by our learned friend, Dr. George Engelmann. To the left, on the east side, is that of Dr. Asa Gray, well known to you all as a bright ornament to American science. These men are and have been shining lights as naturalists in describing and classifying the numerous and various objects of the vegetable kingdom. These monuments are durable mementoes of our esteem and respect for illustrious men whose names are indelibly connected with the plants and trees that beautify the face of nature, and thus their names will be handed down to future ages and be known as long as science and civilization exist among men."

The marble statues of Juno and Victory were both made by Ross C. Adams of Carrara, Italy. The Juno, now in the Italian garden, formerly stood opposite the main gate in the center of a small formal garden, but the Victory has always stood within the structure it now occupies. Tradition has it that this was originally intended by Mr. Shaw as his mausoleum, but later he decided granite would be more permanent and built the second mausoleum.

The statue of Juno is an exact copy of an antique, now in the National Museum, Naples (photograph No. 5099), and cost $775.00 delivered in St. Louis. The Victory is a copy of a statue by Consain, also in the Naples gallery (photograph No. 523) and cost $1,050.00 delivered. These statues arrived together during the month of September, 1886, and were almost immediately put in place.

Mr. Shaw evidently placed the order for his own monument in 1882, since by March, 1883, Miller had received photographs and begun the preliminary sketches. The granite mausoleum was begun in 1884, and, as is well known, this structure, as well as the statue and pedestal, were completed several years before Mr. Shaw's death. The bronze ornaments and the marble figure of Mr. Shaw were executed in Germany, but the pedestal was made in St. Louis. No record exists of the cost of the monument, but the following itemized account of the preliminary work called for by Mr. Shaw may be of interest:

To the architect Rohmeis for making three drawings and the larger detail	$220.00
For making the whole sarcophagus in wood and gypsum to model the ornaments	88.00
For modeling six wreaths, two inscription plates, and five and one-half metres of garlands	530.00
For the casting of the whole	440.00
For the packing of the marble figure and the bronze parts	97.00

STATUE OF JUNO IN THE GARDEN.

STATUE OF VICTORY IN THE GARDEN.

Apparently, the artistic temperament of the sculptor was somewhat disturbed by having to furnish such a detailed account of expenses, for after an impassioned letter he concludes as follows: "Finally, I beg you to excuse me for having written to you as much about the matter, but think yourself in my place who has never received a similar reproach and you will find my excitement excusable. Nevertheless, I shall still esteem you as my fatherly friend. May you live a great many years yet, may God bestow upon you health and prosperity."

On July 6, 1884, the marble busts of Wagner and Beethoven were presented to Tower Grove Park. These were both executed by von Miller, and the reference in the previously quoted letters to these busts, particularly as to the source of the study for the Wagner marble, is interesting. After the unveiling, which ceremony was performed by Miss Carson, Mr. Shaw and Dr. Wm. Taussig made brief addresses. Dr. Taussig, "in the name of the art-loving community of St. Louis, thanked Mr. Shaw for adorning that beautiful park with the busts of those two immortals, Beethoven and Wagner." The Henry Shaw Musical Society rendered an elaborate program made up exclusively of compositions of the two musicians honored, and "at its close the members of the society adjourned to the residence of Mr. Shaw, where an hour was pleasantly spent in sauntering through the grounds."

The busts of Gounod and Verdi are presumably the work of Ross C. Adams, the same sculptor who did the Victory and Juno. The Verdi shows no mark indicating its origin, but the Gounod bears the faint inscription "C. Nicoli & Adams." It is believed that Nicoli, of Carrara, who was a well-known sculptor of the day, was associated with Adams in some way in the execution of the Gounod bust at least, and possibly also the one of Verdi.

The following extract from the Globe-Democrat of May 16, 1886, gives a general account of the ceremonies attending the presentation of these works of art:

"A typical opening day, a large concourse of people, and a perfect smoothness of all arrangements combined to make the ceremonies incident to the unveiling of the busts of Gounod and Verdi an unusual success. The busts were the gift of Mr. Henry Shaw, adding another token of the munificence to which is due the existence of the beautiful resort in which they are located. They stand, with a number of other works of art, upon the outer edge of the circular esplanade around the central music stand. Both are highly creditable to the skill of the sculptor and the taste of the giver.

"The ceremonies were preceded by a portion of a musical programme, beginning at 4 o'clock with the massive and sonorous grand march from the opera 'Faust' by Gounod. The grand fantasie and march from 'La Reine de Saba' by the same composer, potpourri from 'Traviata,' and a brief selection from 'I Lombardi' by Verdi, followed, when Mr. Shaw, who was in unusual voice and spirits, mounted the platform and in a brief speech tendered the busts to the city. When the applause died away, acting Mayor Allen accepted the gift in a few complimentary sentences and introduced Mr. Peter L. Foy, who spoke for about five minutes, briefly reviewing Mr. Shaw's many acts of public and private philanthropy. Mr. E. C. Kerr and Prof. Woodward followed in a similar vein and the ceremonies proper concluded. The crowd, however, tarried to hear the conclusion of the musical programme which was made up of selections from the works of Gounod and Verdi, and admirably rendered by Postlewaithe's orchestra of 25 pieces. The speakers of the day and a few invited guests then adjourned to Shaw's Garden where they were entertained until dark."

After Mr. Shaw's death a letter from the Rev. Hubert Lowe, of London, showed that it had been Mr. Shaw's intention to complete the group of busts around the music stand at the park, by adding those of Sir Arthur Sullivan and Donizetti. In fact, he seems to have commissioned his cousin, Mr. Lowe, to have the two busts executed by a London sculptor. However, the practice of being the single donor of the works of sculptors to the city inaugurated by Mr. Shaw, seems to have died with him and, as yet, he has no successor in this particular field.

HYBRID NYMPHAEAS

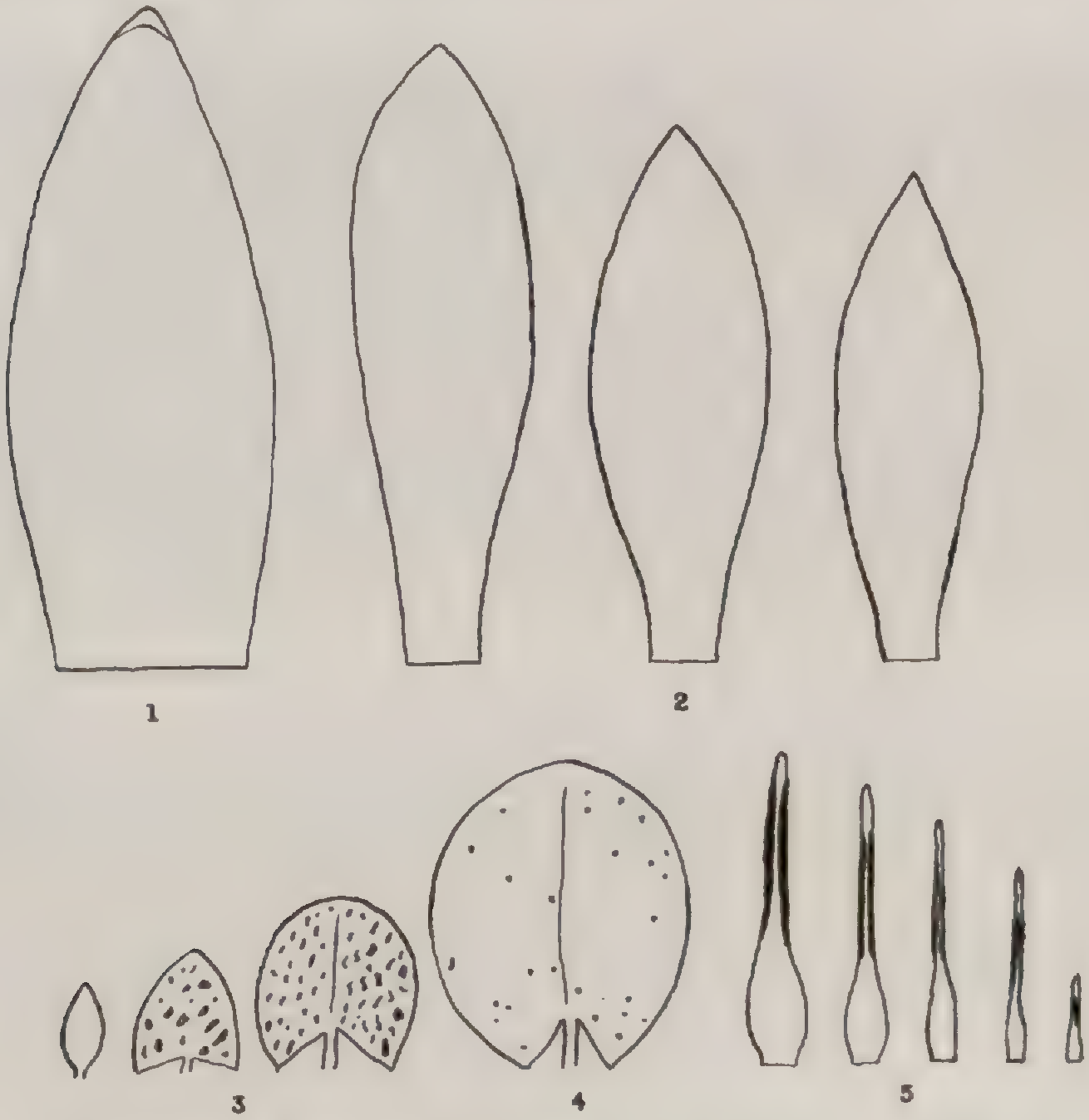
The continuation of the work of breeding water-lilies at the Garden is gradually developing types of greater desirability and effectiveness. The production of that admirable type, *N.* "Mrs. Edwards Whitaker," in 1917, has led to its use as a parent in an effort to increase the size, improve the coloration, and add vigor to other promising types. Among these new hybrids a very pleasing new variety has been secured, *N.* "General Pershing." Another introduction of merit is *N.* "Mrs. Woodrow Wilson" hort. var. gigantea, notable for its size and the greatly increased viviparous habit.

× NYMPHAEA "GENERAL PERSHING" PRING. N. HYB.

(*Nymphaea* "Mrs. Edwards Whitaker" ♀ × *N. castaliiflora* ♂)

The floral character of this hybrid strongly resembles that of the staminate parent, especially in the concave formation of the pistils, as well as compactness and the formation of three distinct whorls of light pink. The exterior

of the outermost petals is channeled longitudinally with green and striped with dark purple. The sepals are pinkish white on the interior, externally strongly resembling the pistillate parent with its coloration dark green prominently striped with purple. The foliage is similar to the seed parent, the upper surface being dark green conspicuously blotched with dark purple, but the margins are more undulated than either parent. The under side is green,



Nymphaea "General Pershing:" 1, sepal; 2, petals; 3, submerged leaves of seedling; 4, first floating leaf; 5, stamens. One-half natural size.

grading to greenish red toward the margins and spotted with a slightly darker color. Owing to the low percentage of developed seeds of the pistillate parents, very few seedlings were obtained. However, the colors of the progeny when flowered were all pink shades, showing the dominant factor of the pollen parent, *N. castaliiflora.*

Description.—Flowers 8–10 inches across, opening from 4–6 successive days from 7:30 A. M. to 7:00 P. M. during August, extremely fragrant; bud ovate-acuminate, dark green, prominently striped with dark purple in the apical

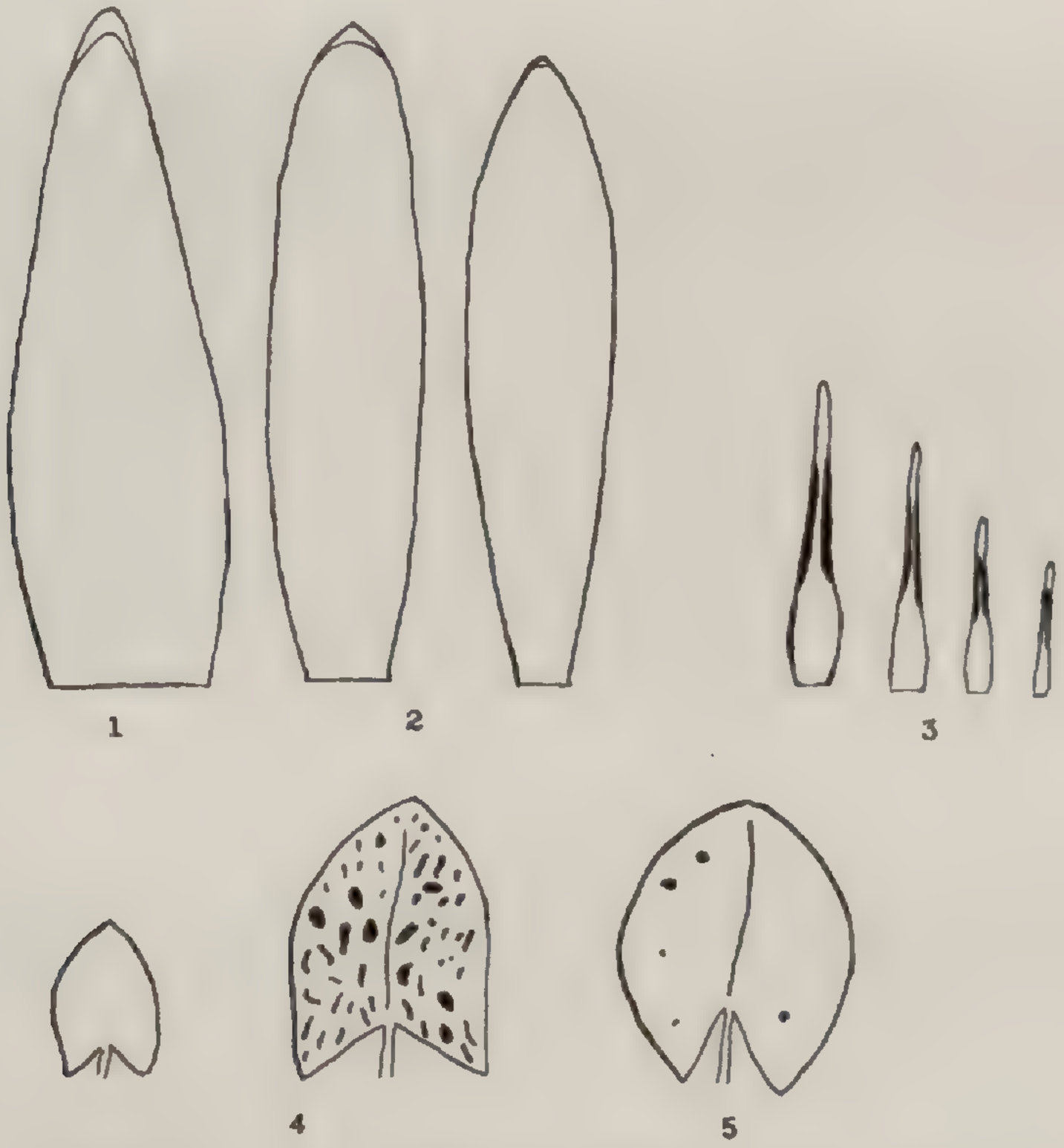
portion; peduncle rising 1 foot above the water, in cross-section showing 7 main air-canals circled by 14 smaller ones, these again irregularly surrounded by minute air-canals; sepals wedged, ovate, 4 inches long, 1¾ inches wide, hooded at the apex, thick and fleshy in texture, outer surface dark green striped with purple, less at the base, light pink on the margins, inner surface pinkish white, light green at the base, showing 10–12 nerves; petals 30, comprising three whorls; outermost whorl lanceolate-obtuse, slightly hooded at the apex, 3¾ inches long, ⅞ of an inch wide, with the outer surface channeled longitudinally with green and striped with purple, thick in texture except along the light pink margins, and the inner surface light pink, 7-nerved; the inner whorls light pink, slightly acute, becoming shorter and narrower toward the innermost; stamens about 300; outermost whorl occasionally becoming petaloid, 1⅞ inches long, with appendages ovate-oblong at the base, bright yellow, pink and pinkish white at the apex; the inner whorls becoming shorter and narrower toward the innermost, which are linear, yellow, and yellowish white at the apex; carpels 35–40, with carpellary styles oblong-obtuse, introrse, dark yellow; fruit globose, containing more fertile seeds than *N.* "Mrs. Edwards Whitaker" but considerably less than *N. castaliiflora;* leaves of submerged seedling light green with reddish brown spots on the uppermost side, ovate to deltoid; first floating leaves orbicular, dark green spotted with greenish brown on the upper side, under side light green tinted with bluish brown, spotted with purple; developed leaves suborbicular, 14 inches across, peltate, with deeply sinuate undulated margins, upper surface dark green spotted with brownish purple, brownish toward the margins, the under surface light green in the center, pinkish toward the margins, spotted with reddish brown; basal portion of leaves overlapping, terminating in short acute lobes; sinus nearly closed.

× NYMPHAEA "MRS. WOODROW WILSON" HORT. VAR. GIGANTEA, PRING, N. HYB.

(*Nymphaea* "Mrs. Woodrow Wilson" Tricker ♀ × *N. castaliiflora* Pring ♂)

The viviparous habit of *N. mierantha,* the West African species, is a dominant factor transfused through *N. Daubeniana* to the pistillate parent of the hybrid. The peculiar leaf vegetation is important, enabling the increase of stock without the use of tubers. The latter in most cases is a slow means of reproduction peculiar to the Brachyceras group. The result of intercrossing *N.* "Mrs. Woodrow

Wilson" with the pink *N. castaliiflora* brought both the normal leaf development and the viviparous type, the flowers retaining the bluish color of the seed parent. The seedlings showing the vegetative leaf character have an extremely low percentage of fertile seeds, whereas the non-vegetative types have a high percentage of minute seeds for perpetuating the type. The influence of the parent, *N. castaliiflora*, is apparent in the enlargement of the sepals and petals and the



Nymphaea "Mrs. Woodrow Wilson" var. gigantea: 1, sepal; 2, petals; 3, stamens; 4, submerged leaves of seedling; 5, first floating leaf. One-half natural size.

pinkish color fused in the sepals and the outer whorl of petals. However, there is no increase in the number of petals above that of the seed parent. The purple markings are more numerous than in *N.* "Mrs. Woodrow Wilson"; they are totally absent in the sepals and petals of *N. castaliiflora*.

The variety so strongly suggests the seed parent that a varietal name indicating a major form has been attached. It may be distinguished from the type, however, by the tall pedunceles terminating in a much larger flower, darker blue color, pink in the interior of the sepals and petals, the intensified markings externally, the larger leaves overlap-

ping one-third, the deeply undulated margins, and prominent acuminate lobes at the base.

Description.—Flowers 7–8 inches across, opening 4–5 days during August, fragrant; bud ovate-acuminate, green; peduncle rising 1 foot above the water, in cross-section showing 9 main air-canals surrounded by 17, these again by irregular smaller ones; receptacles light yellow; sepals 4-wedged, lanceolate, 3½ inches long, 1¼ inches wide, prominently hooded at the apex, thick and fleshy in texture, outer surface green, yellowish green at the base, striped with purple markings, shaded with blue at the margins, inner surface pinkish white, showing 10–12 nerves; petals 20–25; outermost whorl lanceolate-obtuse, hooded at the apex, 3½ inches long, ⅞ of an inch wide, the outer surface green prominently striped with purple, thick in texture except along the blue margins, 7–8-nerved, inner surface pinkish blue; inner whorls lavender-blue; stamens 140–150; outermost whorl 1½ inches long, with appendages ovate-oblong at the base, yellow, brown on the dorsal side, pinkish blue at the apex; the inner whorls shorter and narrower toward the innermost, which are linear, yellow, white at the apex; carpels 25–30 with carpellary styles short, obtuse; fruit globose, containing very few fertile seeds; leaves of submerged seedling ovate to deltoid, with acute lobes, primary leaves light green, secondary leaves light green with prominent brownish marmorations; first floating leaves suborbicular with acute lobes, dark green sparsely spotted with brown, brownish pink on the under side; developed leaves orbicular, 14 inches across, deeply obtuse, sinuate-dentate, green on the upper surface, pinkish green beneath; basal portion of the leaves overlapping one-third, terminating in acuminate lobes, producing flowers at the insertion of petiole and blade when not detached.

NOTES

The ladies attending the National Safety Congress visited the Garden September 19.

Mr. Alexander Lurie, Horticulturist to the Garden, has been elected a trustee of the St. Louis Florists' Club.

During an absence of two weeks from the Garden, Mr. Alexander Lurie visited places of horticultural interest in New York, Philadelphia, and Washington.

Mrs. Katherine H. Leigh, Secretary to the Director, is now in France, having been granted a leave of absence to accept a position in the personnel department of the American Red Cross.

Mr. John Noyes, formerly landscape adviser to the Garden, has been appointed an assistant town planner, and is now engaged in an elaborate Government housing proposition at Davenport, Iowa.

Mr. C. L. Moody, formerly in charge of trees and shrubs at the Garden, is at Camp Devens, Ayer, Mass., having attained corporal rank since being drafted. Other Garden employes who have entered the military service recently are Mr. Adam Huber and Mr. C. McGovern.

The 34th annual convention of the Society of American Florists and Ornamental Horticulturists was in session in St. Louis at the Moolah Temple, August 20–22. The members and their wives were guests of the Garden the evening of August 22, when a supper was served outdoors.

Recent visitors to the Garden include Captain A. R. Davis, of the Coast Artillery, U. S. Reserves, formerly Research Assistant at the Garden; Professor C. A. Shull, Associate Professor of Plant Physiology and Genetics, University of Kansas; Dr. A. L. Bakke, Assistant Professor of Botany, Iowa State College; and Ensign Henry Schmitz, of the Naval Reserves, formerly Rufus J. Lackland Fellow.

Of the former Garden pupils, Mr. Clarence Pedlow has accepted a position as Instructor in Horticulture at the Agricultural and Engineering College, Raleigh, N. C.; Mr. Carl Giebel is now Sergeant in the Engineers Corps, stationed at Chattanooga, Tenn.; Mr. Robert Mitchell has enlisted in the Navy and is now at the Great Lakes Training Station; Mr. N. S. Philippi is in an army railroad camp in Washington, laying out roads through the forests; Private P. A. Kohl has last been heard from in Tours, France; Sergeant George Pedlow is on a furlough behind the lines, after having been in the thick of the fight at Chateau Thierry.

STATISTICAL INFORMATION FOR JUNE–AUGUST, 1918

GARDEN ATTENDANCE:

Total number of visitors in June	22,486
Total number of visitors in July	19,258
Total number of visitors in August	19,278

PLANT ACCESSIONS:

Total number of plants and seeds donated in June	73
Total number of plants and seeds donated in July	400
Total number of plants collected in July	15

PLANT DISTRIBUTION:

Total number of plants distributed in exchange in July	403

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	32
Total number of books and pamphlets donated in June	155
Total number of books and pamphlets bought in July	13
Total number of books and pamphlets donated in July	84
Total number of books and pamphlets bought in August	5
Total number of manuscripts and pamphlets donated in August	49

HERBARIUM ACCESSIONS:

By Purchase —

Rev. John Davis—Plants of Missouri, South Carolina, etc.	150

By Gift —

Prof. G. F. Atkinson—*Thelephora, cuticularis* Berk. from Virginia	1
Dr. John T. Buchholz—*Drosera annua* Reed, and a cultivated specimen of *Elodea canadensis* Michx. var. *gigantea* Hort. from Arkansas	2
H. Calkins—*Cirsium arvense* (L.) Scop. from Pacific, Missouri	1
J. A. Drushel—Plants of the United States	14
J. A. Drushel—Plants of Missouri, Texas, and New York	15
Dr. C. E. Fairman—Fungi of Orleans Co., New York	3
Dr. H. D. House—*Stereum Willeyi* Pk	1
Prof. H. M. Jennison—Fungi of Bozeman, Montana	3
I. M. Johnston—*Senecio* from California	4
W. C. Lilley—*Monotropa uniflora* L. from Iowa	1
C. G. Lloyd—Collections of *Hymenochaete* from various localities	85
S. H. Moreton—*Hoheria populnea* Cunn. from New Zealand	1
J. C. Nelson—*Senecio* from Oregon	3
Dr. Norma E. Pfeiffer—*Hydrodictyon reticulatum* (L.) Lagrh. from Tower Grove Park, St. Louis	1
A. D. Rudolph—*Mutinus caninus* from Illinois	1
Dr. J. R. Schramm—*Rhinotrichum* sp	1
Dr. J. R. Weir—Rocky Mountain Fungi	6

By Exchange —

Prof. J. C. Arthur—*Puccinia Eatoniae* Arthur from Indiana, and *P. Liatridis* (Ell. & And.) Bethel from Colorado	2
E. D. Merrill—"Species Blancoanae," Plants of the Philippine Islands	1,060
New York Botanical Garden—Plants of Jamaica	76
University of Texas, by Dr. Mary S. Young—Plants of Texas	145

By Field Work —

Dr. J. M. Greenman—Plants of Missouri	280
Dr. J. M. Greenman—Plants of St. Louis Co., Missouri	27
TOTAL	1,883

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

JESSE M. GREENMAN,
Curator of the Herbarium.

JAMES GURNEY,
Head Gardener, *Emeritus.*

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI OCTOBER, 1918 No. 8

CONTENTS

	Page
Effect of Electricity on Plants	97
Winter Protection of Plants	100
Testing of Potato Varieties	103
Notes	104
Statistical Information	106

ST. LOUIS, MO.
1918
Published Monthly Except July and August by the Board of Trustees

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERICK A. HALL,
Chancellor of Washington University.

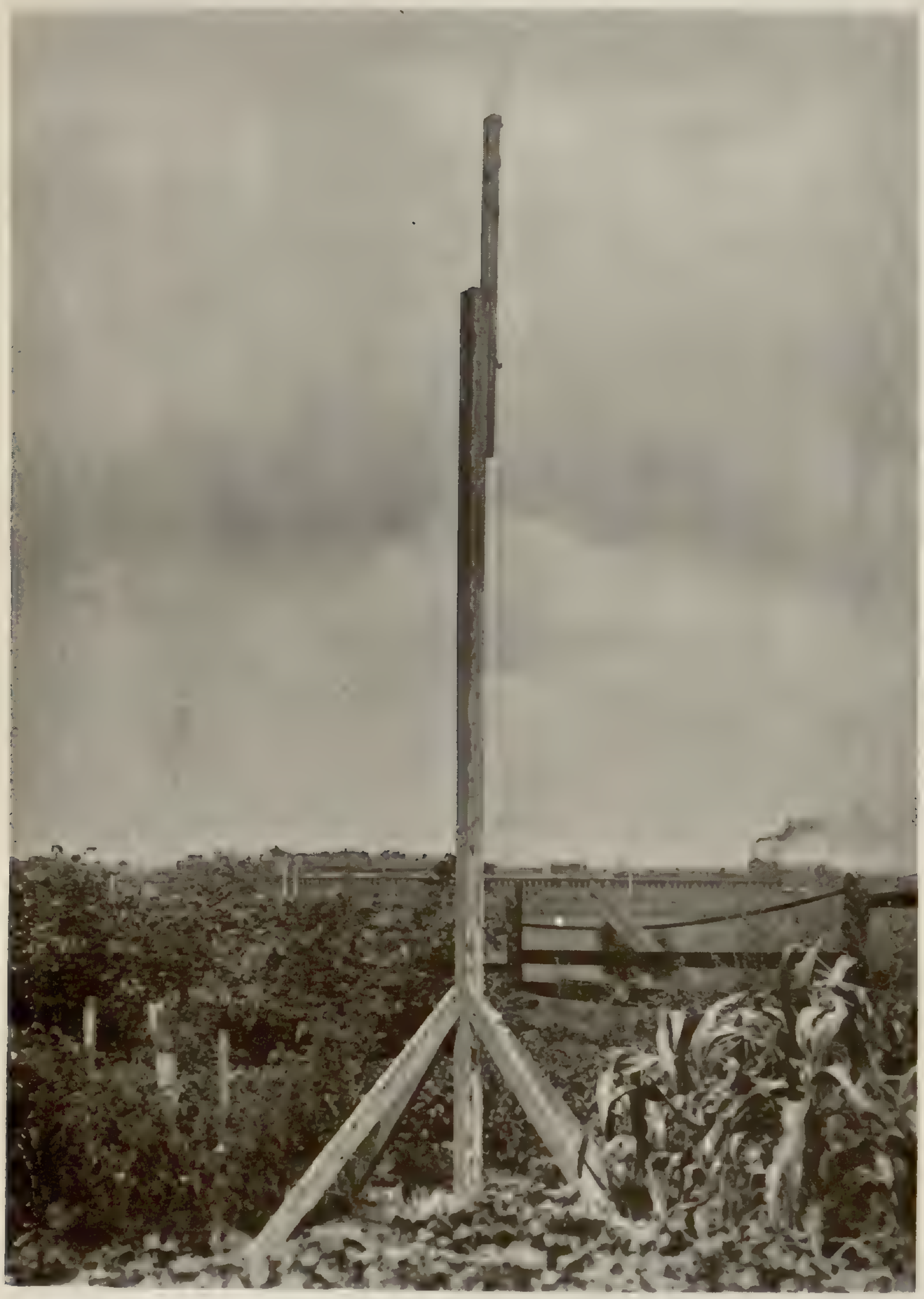
HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

HENRY L. WOLFNER,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary



"ELECTRIFIER" USED AT THE GARDEN.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., October, 1918 No. 8

EFFECT OF ELECTRICITY ON PLANTS

The relation that exists between electrical stimulation and plant growth has been a subject of many experiments of varied range, resulting in conflicting and contradictory conclusions. Investigations have been carried on for over 150 years, since it was first supposed that electricity, which manifests itself so universally in nature, would be capable of plant stimulation under certain conditions. It has been shown by Elfving, Brunchorst, etc., that roots are susceptible to the influence of galvanic currents. Through the experiments of Kunkel it has also been proved that electric currents exist in plants and that differences in potential (Haake) are caused by metabolism and respiration.

The greatest attention was at first centered upon the influence of current electricity on plants. In 1746, Mainbray, Nollet, and Jallabert tried the effects of electric currents upon fruit trees and seeds with marked stimulative results. Vigor and germinative powers were found to be considerably increased by the experiments of Boze, Menon, De Lacepede, Marat, etc., but Gardini, Sylvestre, Paets, and several others secured negative results with overhead electric wires. While Humboldt believed that electricity exerted considerable influence on plant growth, de Candolle concluded that its effect was negligible. In 1844 Forster's experiments with barley and Ross's experiments with potatoes by means of galvanic culture showed such promise as to arouse considerable interest. On the other hand, very careful extensive investigations of Wollny upon rye, beans, potatoes, beets, etc. showed negative results.

Lemström obtained favorable results with static electricity in a large number of cases, suspending wire meshes over plants and connecting the former with the positive pole, the negative pole being connected with the ground. Due to the careful methods employed, as well as the extended period of experimentation, his results are deemed trustworthy. He demonstrated that strong charges were unfavorable, and

he further arrived at the conclusion that electricity acts in an indirect way, and that a zone is produced by electrical discharges which have an influence on plants. More recent work by Monahan, Kinney, and Stone showed considerable acceleration in seed germination and growth through the aid of weak currents.

In 1917 Prof. Hendrick reported upon four years' tests carried on in England with overhead installation and arrived at the general conclusion that no consistent improvement in crops grown was noticeable. In February, 1918, however, an electrical engineer, R. C. McCreery, of Chicago, issued a report upon effects of electrification of corn and beets. The results showed an increase in germination of seed of 31–39 per cent, an increase in rapidity of growth of 30–50 per cent, increased production of forage and grain of 30–40 per cent. The device employed distributes the current through special electrodes embedded in the soil at a depth of 6 inches in parallel lines along two opposite sides of the field. From these a high-frequency alternating current is driven through the surface of the soil where it is held by lines of less resistance created by metallically coating the seeds with a non-deteriorating metal before planting.

Since the general belief has been that rational electrification of plants favors their development, increases growth, and hastens maturity, it seemed desirable to attempt to prove or disprove the efficacy of this method of plant growth stimulation. With this end in view the Garden secured an apparatus from France called "Electrifier," patented by Henry de Graffigny. The apparatus consists of a so-called "electrifier" constructed of bronze with 5 prongs of pure nickel, non-rustible and infusible, a copper wire attached to the bottom of the bronze part, a pole 15–35 feet long, a switch, a galvanized iron pulley with an eye for fastening to the pole, a tarred rope for sliding the electrifier down to the base, and two porcelains for attaching the rope to the pole.

The apparatus was set up in the following manner: The soil was removed to a depth of 1½ feet, the radius of the plot being equal to the length of the pole; the pulley was affixed to the top of the pole, while the switch and the porcelains were placed near the base; the tarred rope was passed through the pulley in order to permit of lowering the electrifier to examine the points occasionally; the pole was then placed in the ground deep enough to be absolutely stable; ⅛-inch galvanized iron wire was stretched every 3 feet at the base of the pole and connected with the copper

COMPARISON OF AVERAGE PLANT FROM CHECKED PLOT WITH ONE FROM "ELECTRIFIED" PLOT.

wire attached to the electrifier; finally the soil was moved back over the wires, the plot being ready for planting.

On May 18, 1916, the apparatus was set up, using a 15-foot pole and a plot 30 x 30 feet which was divided into four parts. Tomatoes, string beans, sweet corn, and *Salvia splendens* were planted in the individual sections. Another plot 30 x 30 feet was selected and similar plants were used in the individual sections, serving as a check. The soil was worked in a similar manner but no wires were used.

At the end of the season of 1916 tomatoes ripened two weeks, and corn ten days, earlier upon the electrified plot. Tomatoes averaged 10 to the plant on the electrified and 5 to the plant on the non-electrified plot. Corn and beans showed no difference in yield, while salvia began flowering earlier and attained double the size upon the electrified plot.

The experiment was repeated during the season of 1917, showing ripening of tomatoes and corn to correspond exactly to that of the previous season. Beans and salvia also matured and flowered one week earlier upon the electrified plot. In yield the tomatoes averaged 11 per plant upon the electrified and 8 per plant upon the non-electrified plot, while beans yielded 14 pounds upon electrified and 9½ pounds upon non-electrified. Salvia showed a composite growth of a single plant of 20.6 feet against 14.1 feet upon the non-electrified plot.

In 1918 a repetition of the same experiment, shifting the apparatus to the plot previously used as check, showed similar results. The earliness of maturity, as well as the yields, remained constant for all crops. Salvia did not show quite the decided difference as in previous experiments, the electrified plants averaging 17.3 feet, while the others averaged 12.5 feet.

The results of the experiments conducted indicate that there would appear to be some merit in the apparatus and the methods employed. All crops which presumably were influenced by an electric current conveyed by the apparatus showed considerable increase in vegetative, as well as reproductive, growth, and the date of maturity was hastened.

The phenomena underlying electrical stimulation are still imperfectly understood and the precise explanation of any favorable results obtained is not known. There are many theories, however, in regard to its action. Nollet, Jallabert, and Lemström held that the accelerated growth was induced by increase in the movements of the sap. Tschinkel maintained that electricity rendered soluble the salts and other constituents, while Jadro believed in the mechanical action,

as well as the chemical, which set particles of soil into a state of vibration resulting in greater growth. Kinney and Stone have shown that positive charges increased the growth of roots, while negative ones acted on the stems. This might be explained by the fact that the protoplasm of the roots and stems contains particles which are charged positively and negatively.

In general, it may be said that while some experiments seem to demonstrate the favorable effect of the electrical treatment, many others are negative or may be explained on other grounds. Before any definite practical application can be made of the use of electricity in growing plants, it is necessary to realize (1) the need for quantitative measurements of the electric discharge, (2) that a stimulus may act differently on the plant at different stages of its life, (3) that the effect of the stimulus depends upon its intensity, (4) that the effect of the stimulus depends on the time at which it is applied, and (5) that the effect of the stimulus may appear a considerable time after it is applied.

EFFECT OF ELECTRICITY ON PLANTS

(Averages for three years)

Treatment of plot	Crop	Average growth per plant	Average number of fruits	Date of maturity
Electrified	Tomato	13 ft.	12 per plant	July 10
Non-electrified	Tomato	11 ft.	7 per plant	July 22
Electrified	Corn	13 ft.	2 per plant	Aug. 10
Non-electrified	Corn	10 ft.	2 per plant	Aug. 20
Electrified	Beans	2.44 ft.	14 lbs. per plot	July 5
Non-electrified	Beans	2.03 ft.	10 lbs. per plot	July 12
Electrified	Salvia	20.6 ft.	.....	July 10
Non-electrified	Salvia	14.1 ft.	.....	July 20

WINTER PROTECTION OF PLANTS

Effective winter protection consists of assistance rendered by man to nature in its effort to carry plants through the hardships of severe winters. The attempts to afford protection to tender plants generally result in a futile waste of time and money. It is difficult to protect a tender plant from frost when the thermometer stands below zero and the

ground has been frozen two or more feet deep, for under such conditions its temperature will soon equalize itself with that of the surrounding air, despite a thick covering. The function of a protective dressing lies chiefly in its reduction of evaporation, which is very excessive during dry winters of light snowfall. Being frozen, the roots cannot respond to the drain upon the plant's system, and the parts exposed to the action of the atmosphere consequently shrivel. A mulch also serves a useful purpose in preventing alternate thawing and freezing, which is particularly injurious in heavy soils, causing the heaving out of plants with irreparable damage to the roots. Excessive packing and baking of the ground through the weight of snow and rain is also eliminated.

The chief protection afforded trees and shrubs usually consists of a mulch 4–6 inches deep of well-rotted manure, straw, or other litter, placed over the roots when planted in the fall. If planting is to be delayed until spring, the trees or shrubs may be heeled in; i. e., the roots are laid in a shallow trench, covered with well-drained, sandy soil, and later given a covering of straw. Occasionally, newly planted, large trees need protection over winter in order to acclimate them gradually to a colder climate than that of their nativity. Such trees should be given a mulch at the roots, while the tops should be tied close to the main trunk, covered with a 6-inch thickness of straw or hay, and finally tied with burlap. The latter serves to keep the wind out and sheds water. Where available, hemlock boughs effectively replace the straw and burlap.

Among shrubs the rhododendrons as a class require winter protection. When planted, a location sheltered from winds and midday sun should be selected, a permanent evergreen being an admirable windbreak. In addition, as soon as cold weather sets in, a mulch of leaves 10–12 inches deep should be placed over the roots, while tall evergreen boughs should be stuck into the ground and bent over the tops of the plants.

Native roses, as well as many of the hardy Chinese and Japanese kinds, need no covering, but the various hybrid types, such as hybrid perpetuals, hybrid teas, teas, etc., will not withstand our winters unless a measure of protection is afforded. The climbers, being largely offspring of the hardy Wichuraiana and multiflora types, are comparatively hardy except during such a severe winter as was experienced in 1917–18. To be reasonably sure of saving the entire cane growth and thus preserving the flower buds, the long canes should be laid down, pegged to the ground, and cov-

ered with a mulch of soil 10 inches deep combined with a light layer of manure on top. A mere mat of straw placed around the canes on the trellis will be of little avail in severe weather. It is essential in covering the vines that no portion be left exposed, otherwise the entire cane above the dead section will have to be removed, nullifying the whole procedure. The tender roses should be protected by hilling loose soil around each plant to a depth of 6–8 inches and mulching the entire beds with a 3–4-inch covering of well-rotted, strawy manure. The wood above the mulch will shrivel and die during winter, but since the flowers are borne upon new wood in the spring no damage is done. The mulch should be put on just before continuous cold weather sets in and removed as soon as the sap begins to flow in the spring. Failure to remove the mulch in the spring will cause a spindly growth which may be killed back by late frosts. Small beds may be covered by placing a wooden frame around the bed and stuffing it with straw or hay. Boxes, barrels, and other contrivances may be used, providing care is taken to avoid smothering plants or allowing water to stand at the roots.

In loose sandy soils the herbaceous perennials need but little protection besides their natural covering of dead branches and leaves. However, a light mulch 2–3 inches deep placed over perennial beds after the ground has frozen is beneficial, particularly in heavy soils where heaving is liable to take place. Too heavy a covering has a tendency to rot the crowns of such biennials as Digitalis, Campanula, etc., and a heavy snowfall without any mulch is usually the best protection. Young herbaceous perennials and pansies are best wintered over in cold-frames. The plants should be allowed to freeze and straw mats then be placed over the frames. Sufficient light and ventilation should be afforded to prevent the plants from rotting, but not enough to thaw them out, and early in the spring the mats should be removed.

A somewhat different method of winter protection has been tried, based upon the theory that dark colors absorb heat, while light colors reflect it. In this latitude winter killing of the peach fruit buds is usually due to freezing after being stimulated into growth by warm weather. This stimulus may be due entirely to warmth and be practically independent of root action. It has been found that fruit buds may safely endure 10–20 degrees below zero if well matured, but if swollen by premature warmth may be killed at zero. Several applications of whitening during winter and spring have been of benefit in reducing winter killing.

Whitewash mixed with 1 pound of salt to every bucketful was the material used.

TESTING OF POTATO VARIETIES

During the season of 1918, which was particularly unfavorable for potato culture in this vicinity, a number of varieties were tested at the Garden in order to determine the relative value of each under the climatic conditions of St. Louis. While too great reliance should not be placed upon the results, since they represent the tests for but a single year, the table given below indicates that there is a very decided difference in the yield from different varieties, and that while within certain limits the number of potatoes obtained from one variety might vary, the probabilities are that of those tested the Irish Cobbler, Early Ohio, and Triumph potatoes are the ones most likely to produce the highest yield in this vicinity. The table also indicates that the much-advertised method of planting potato peelings instead of strong eyes does not seem to be worth while for St. Louis growers.

Variety	Amount planted	Length of row	Harvest	
			Per 210 ft.	Per acre
Irish Cobbler.....	1 pk.	210 ft.	1.92 bu.	161 bu.
Early Ohio.....	1 pk.	210 ft.	1.43 bu.	120 bu.
Triumph	1 pk.	210 ft.	1.12 bu.	94 bu.
Early Rose.....	1 pk.	210 ft.	.76 bu.	64 bu.
Carman No. 2.....	1 pk.	210 ft.	.68 bu.	57 bu.
Rural New Yorker...	1 pk.	210 ft.	.59 bu.	50 bu.
Burbank	1 pk.	210 ft.	.40 bu.	34 bu.
Peelings	.....	210 ft.	1.00 lb.	.....

Since many ingenious methods for growing potatoes have been developed at various times for the benefit of the amateur, a few tests were made in order to determine whether these methods were practicable or not. One of the most widely advocated means of growing potatoes for the backyard is the so-called barrel method. Last spring a piece of ground 2 feet square was carefully fertilized, and 500 grams of selected pieces of potatoes were planted 2 inches deep in this space. A barrel open at both ends and with perforations at intervals on the sides was placed over the planted area. As the vines grew the barrel was gradually filled with rich soil until finally the foliage extended over the top. According to the claims made for this system, potatoes should form all along the vine to the top of the barrel, producing a crop which far exceeds one grown in

the normal way. The test at the Garden, however, does not warrant such a conclusion, as the crop harvested weighed but 100 grams, or only one-fifth of the amount planted.

Another method advocated for those who have not sufficient garden space to grow potatoes in the ground consists of using several bins placed one upon the other. These are filled with rich soil and planted in the ordinary manner with pieces of potatoes containing one or more strong eyes. In the test at the Garden 5,000 grams of potatoes planted in this manner yielded but 470 grams.

Results obtained from one year's test at the Garden would indicate, therefore, that neither of these two special methods are worthy of serious consideration for those who have to grow potatoes under the rather unfavorable conditions which must always obtain in this vicinity.

NOTES

An article on "Fall Planting" by Mr. Alexander Lurie, Horticulturist to the Garden, appeared in the October number of the Garden Magazine.

Dr. George T. Moore, Director of the Garden, has been appointed Director of the Productions Division of the United States Food Administration for St. Louis.

Prof. E. T. Bartholomew, Assistant Professor of Botany, University of Wisconsin, accompanied by Mrs. Bartholomew, visited the Garden September 20, on their return east from California.

Mr. R. S. Kirby, who is engaged upon cereal rust investigations for the United States Department of Agriculture, spent several days at the Garden recently and has established here experimental plots for rust "wintering over" tests.

The September issue of the Journal of the International Garden Club contains an article on "Wild Plants in Ornamental Planting" by Mr. Alexander Lurie, Horticulturist to the Garden, and one on "Cycads" by Mr. G. H. Pring, Floriculturist to the Garden.

Volume V, Number 3, of the Annals of the Missouri Botanical Garden has been issued with the following contents:

"The Thelephoraceae of North America. IX." E. A. Burt.
"A New Selaginella from Mexico." J. M. Greenman and Norma E. Pfeiffer.

"Algological Notes. III. A Wood-penetrating Alga, Gomontia lignicola, n. sp." George T. Moore.

The Rufus J. Lackland fellowships for the year 1918-19 have been appointed as follows:

Mr. R. W. Webb, B.S. Clemson College; and Prof. R. A. McGinty, B.S. Alabama Polytechnic Institute, Associate Professor of Horticulture, Colorado Agricultural College.

Other appointments include the following:

Mrs. Emily D. Schroeder, M.S. Washington University, research assistant; Miss Joanne L. Karrer, B.S. and M.S. University of Washington, teacher of biology and chemistry, Puyallup High School, Puyallup, Washington, and Mrs. Adele L. Grant, B.S. University of California, teaching fellows in the Henry Shaw School of Botany of Washington University.

In addition to the above, Mr. T. Matsumato, B.S. Tohoku Imperial University, Japan, M.S. University of California, is enrolled as a graduate student; and Dr. S. M. Zeller, B.S. Greenville College, A.B. and A.M. University of Washington, Ph.D. Washington University, has been reappointed special investigator by the Yellow Pine Association to continue his studies on the durability of wood.

STATISTICAL INFORMATION FOR SEPTEMBER, 1918

GARDEN ATTENDANCE:

Total number of visitors	28,219

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	23
Total number of books and pamphlets donated	122

HERBARIUM ACCESSIONS:

By Purchase —

Milton T. Greenman — Plants from Door County, Wisconsin	120
P. Jörgensen—Plants of Argentina	328

By Gift —

Jos. R. Bohr—*Prunus* from Michigan	1
Ira W. Clokey—Senecios from Colorado	10
J. A. Drushel—Plants of the United States	23
Dr. W. H. Emig—Mosses of Oklahoma	3
Forest Products Laboratory of Canada, McGill University —Fungi destructive to timber of mills	3
Dr. Geo. T. Moore—*Cuscuta Epithymum* Murr. from Massachusetts	1
Dr. L. O. Overholts—Fungi from New Hampshire	11
Prof. Chas. A. Shull — *Xanthium globosum* Shull from Kansas	7
TOTAL	507

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas — week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

Benjamin Minge Duggar,
Physiologist in charge of Graduate Laboratory.

Edward A. Burt,
Mycologist and Librarian.

Hermann von Schrenk,
Pathologist.

Jesse M. Greenman,
Curator of the Herbarium.

Katherine H. Leigh,
Secretary to the Director.

James Gurney,
Head Gardener. *Emeritus.*

Alexander Lurie,
Horticulturist.

G. H. Pring,
Floriculturist.

J. J. Coughlin,
Construction.

W. F. Langan,
Engineer.

P. Foerster,
Farm and Stables.

H. Vallentine,
Carpenter

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. VI NOVEMBER, 1918 No. 9

CONTENTS

	Page
Pruning	107
Additional Gift of Orchids by Mr. D. S. Brown	113
Notes	124
Statistical Information	126

ST. LOUIS, MO.
1918
Published Monthly Except July and August by the Board of Trustees

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE NUMBERS TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

HENRY L. WOLFNER,
President of the Board of Education St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary

TREE IMPROPERLY PRUNED.

SAME TREE PROPERLY PRUNED.

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., November, 1918 No. 9

PRUNING

Pruning is a horticultural practice of great importance, but its object is frequently misunderstood and its results looked upon with distrust. When improperly done it may be devitalizing and injurious to plant growth as well as detrimental to its beauty; but the experience of centuries, together with extensive physiological studies and the precedent in nature, warrants the conclusion that scientific pruning is a legitimate procedure, advantageous, and in fact indispensable, to successful growth.

The essentials of pruning consist in the removal of excessive or undesirable living or dead branches and roots for the benefit of the parts that remain. In intelligent hands the process is of vital importance, but as often practiced by tree "butchers" and other "experts" who aimlessly lop and shear trees and shrubs, the only result is to endanger their growth and to despoil them of their natural beauty. The principles of pruning will be considered here under the following heads: (1) street and lawn trees, (2) ornamental shrubs and vines, and (3) fruit trees, bush fruits, and grapes.

Street and Lawn Trees.—The need for pruning trees first arises at the time of transplanting. Since even with the greatest precautions it is impossible to dig up all the roots, it is necessary to cut back the top to maintain a balance. The amount of cutting depends upon the nature of the roots, the less fibrous requiring greater reduction at the top. Usually the removal of four-fifths of the previous year's growth is sufficient, a smooth cut being made just above an outward-pointing bud. The amount of top pruning also depends upon the ease with which the various species are transplanted. A more severe pruning is required for trees difficult to move, such as magnolias, sweet gums, and tulip trees, than for maples, sycamores, elms, poplars, ashes, etc. In general, however, it is better to prune too much rather than not enough, for the more se-

vere the pruning the more compact is the top with an abundance of shoots close to the stem. The roots require no pruning except where bruised or broken.

In this first operation there is no difference in treatment between the lawn and street tree. In later treatment the lawn tree is allowed to grow at will and to assume its natural form, requiring but little attention except the careful removal of dying limbs. On the other hand, the street tree must be straight and symmetrical, with branches beginning at a height sufficient to permit free passage underneath. These essentials are secured through the medium of pruning. The lower branches should be allowed to remain until the trunk thickens enough to support the top, their removal then being accomplished in yearly intervals until a height of 10–12 feet is reached.

The training of the crown consists of the suppression of some branches and the encouragement of others to produce a compact and symmetrical outline. A single leader is desirable in order to eliminate the danger of the formation of crotches with their tendency to split. Strength may be thrown into the central stem either by the removal or shortening of co-leaders. In cases where tops bend over and droop the leader may be tied with raffia to poles and thus forced to remain upright until strong enough to need no support. The loss of a leader may be replaced by training a lateral twig to take its place. All dead and imperfect limbs should be removed. If the top becomes so dense as to exclude the sun from the sidewalk or near-by buildings it should be thinned by removing the third or fourth division of branching, but not the main laterals. In eliminating the lower branches the main laterals need not be removed to any great height, the subdivisions being cut so as to produce a graceful upward sweep.

It is essential to bear in mind that the natural shape and habit of the tree should be preserved and all artificial shaping avoided. The retaining of the natural form involves considerable skill which is often obviously lacking in the treatment of many of our street trees. They should not, however, be permitted to grow beyond certain bounds, their spread being restricted when too much shade is cast upon the roadway or adjoining houses. Shortening of branches is necessary to produce compactness of form. Since the root system usually has the same diameter as the top, and as the poor street soil generally restricts the growth of the roots, the spread of the top should be limited in proportion. The necessity for cutting back is manifested by the branches becoming ragged toward the top and the foliage thin.

Severe cutting back is sometimes necessitated when regular pruning has been neglected, the degree of severity depending upon the power of the tree to send out adventitious buds. Sycamores, soft maples, elms, and poplars lend themselves well to heading back.

The operation of pruning should begin at the top, as by doing so it is easier to shape the tree, besides saving time in clearing off the cut limbs. All cuts should be made close to the base of the limb and parallel to the axis of the trunk. Stubs should never be left, as decay would soon ensue, penetrating to the heart and eventually destroying the tree. To avoid splitting and tearing the bark, the limb should be sawed half way through on the under side about 10 inches from the base, and the final cut made at the shoulder. The weight of the limb will cause it to split off at the upper cut without injuring the bark. If the limb is so large as not to split horizontally to the upper cut, the cut at the shoulder is made half way through and then another cut opposite will cause the limb to drop off. The stub left is then easily sawed off without damage. No matter how small the scar, a protective and disinfectant dressing should be applied immediately to prevent decay until the callus grows over the wound. Paint made of linseed oil and white lead makes a good dressing provided it is applied again after checking of the wood has taken place. Coal tar and various asphalt preparations also make desirable dressings.

Heavy pruning should be done in the fall or winter while the trees are in a dormant condition. The shaping should be done during August or September when it is easier to discover the weak, imperfect or dead branches. Early spring or summer pruning is not advisable, as the rapid flow of sap leads to bleeding, stripping of the bark, and a check to the root system by removal of elaborated food material.

The tools required for pruning are: pruning saws of various sizes, but always single-edged, as a double-edged saw is harmful to the tree; an ax; a pole pruner; pruning shears; and a ladder.

Ornamental Shrubs, Roses, and Vines.—The pruning of shrubs at the time of transplanting is similar in principle to that suggested for trees. A balance should be maintained between the root system and the top by cutting back the individual branches at least one-fourth, the severity depending upon the root system and the species planted. The general purpose of pruning shrubs is to aid the plant to assume its natural form and characteristic beauty, and therefore only

diseased, interfering, or misshapen growths should be removed. Occasionally the dictates of formal gardening require shaping into artificial forms, but ordinarily such shearing results in mutilation and disfigurement. Trimming of shrubs is justified when increased vigor is sought, this being accomplished by gradual thinning of the old wood and, in exceptional cases, cutting back to the ground plants that lose their winter attractiveness as the stems grow old (Cornus, Kerria, etc.). Before any pruning of shrubs is attempted it is essential to recognize their flowering habits. The spring and early summer-blooming kinds produce flowers upon wood which is formed during the previous year, thus necessitating pruning shortly after the flowering season so that the new growths may develop buds for the next season. The late summer and fall-blooming plants produce flowers on the same season's wood and require pruning in the fall. In either case, the work should be done after flowering.

The following table indicates the more common shrubs and the groups to which they belong. Those marked with an asterisk are profited by annual pruning.

SPRING AND SUMMER-FLOWERING	LATE SUMMER AND FALL-FLOWERING
Benzoin aestivale	**Amorpha fruticosa*
Berberis Thunbergii	**Buddleia Davidii* (cut back in spring to prevent danger of rotting)
Cercis canadensis	*Ceanothus americanus*
Chionanthus virginica	*Cephalanthus occidentalis*
Cornus (numerous species)	**Clethra alnifolia*
Cotoneaster (numerous species)	*Hamamelis virginiana*
**Deutzia* (numerous species)	*Hibiscus syriacus*
**Diervilla hybrida*	**Hydrangea arborescens*
Dirca palustris	**Hydrangea paniculata*
Elaeagnus angustifolia	**Sambucus canadensis*
Euonymus (several species)	**Sorbaria arborea*
Forsythia (several species)	*Spiraea Billiardii*
Hippophae rhamnoides	*Spiraea Douglasii*
**Kerria japonica*	*Spiraea tomentosa*
Ligustrum (several species)	*Symphoricarpos racemosus*
Lonicera (several species)	**Vitex incisa*
Philadelphus (several species)	
Physocarpus opulifolius	
Rhamnus cathartica	
Rhodotypos kerrioides	
Robinia hispida	
Spiraea prunifolia	
**Spiraea Thunbergii*	
Spiraea Van Houttei	
**Stephanandra flexuosa*	
Syringa (numerous species)	
Viburnum (numerous species)	

The matter of pruning hedges is of vital importance. The prime requisite of a hedge is a thick bottom, which is

secured in most cases by a severe cutting back, sometimes to within 6 inches of the ground, at the time of planting. Most hedges require trimming several times a year, the last cutting being given early enough in the fall to allow thorough ripening of the wood and avoidance of winter killing. The best form for a hedge is rounded at top, permitting a more natural development. The privets, however, readily adapt themselves to the flat-top pruning.

Garden roses represent many species, differing in habit and requiring different treatments. Before pruning the hybrid teas one must decide what kind of a crop is wanted. If the largest and finest flowers are sought the plants must be thinned and pruned severely, but where abundance is of prime importance for effect, more shoots are left. Pruning of hybrid teas consists of two operations—thinning of dead or weak canes and cutting back the remainder, being performed in the order given. In general the weak-growing varieties can be pruned more heavily than those of strong growth. By hard, moderately hard, medium, and sparing pruning the following is meant:

Hard—Thin out all but 3–5 canes and cut these to 3 eyes each.

Moderately hard—Thin out all but 3–5 canes and cut back to 5–10 eyes.

Medium—Thin out to 5–7 shoots and cut back one-half.

Sparing—Thin out to 5–7 shoots and trim the tips.

Hybrid perpetuals do not require severe pruning, being usually thinned out but a trifle and the canes cut to 2–3 feet from the ground unless winter-killed. The shoots should be shortened after blooming, so that strong new canes may be secured for the next season. The polyanthas and baby ramblers usually require the removal of fruits, while the rugosas and moss roses need only the old and scraggly shoots cut out. The climbing roses need little attention except to keep them within bounds, allowing relatively few canes to grow, which should be well spaced on the trellis, and removing the old ones from time to time. The Wichuraiana and rambler types produce flowers on the wood of the previous year and thus should be pruned after flowering and in the spring.

Vine pruning consists merely of removing the old shoots and cutting back straggling growths, bearing the same principle in mind as that for shrubs in so far as the blooming period is concerned—namely, pruning after blooming. Vines which are grown for their ornamental fruit should be cut hard in early spring, as they fruit on the new wood.

Fruit Trees, Bush Fruits, and Grapes.—Fruit trees are pruned for the purpose of enabling them to produce a superior quality of fruit, the fundamental conception being to reduce the struggle for existence among branches so that the remainder may yield larger and finer products. Heavy pruning of the top during dormancy produces very vigorous growth, due to the same amount of root energy being concentrated into a smaller top. Conversely, heavy pruning of roots reduces wood growth, the top receiving less water supply from the diminished roots. Too vigorous a growth reduces fruitfulness and should be avoided. It is essential to know the fruiting habits of various fruits for intelligent pruning. The apple and the pear bear upon spurs, while the peach bears upon shoots of previous season's growth, indicating that similar methods cannot be employed in the two cases. The entire operation usually resolves itself into a systematic, yearly thinning-out of weak, interfering branches, thereby deflecting energy into the sound limbs and at the same time promoting healthfulness by admitting the sun to the innermost parts and permitting convenient spraying and picking.

In order to lay the fundamentals of a desirable head, young trees are pruned so as to leave 4–5 of the best side branches which are headed back to a few buds each. The leader is removed to make an open-headed tree, except in the case of the peach and plum, where it is left, and the side branches pruned to spurs of one bud each. Old, weak, and neglected trees may be considerably revived and renewed by severe pruning known as "dehorning." The severity of heading-in depends largely upon the vigor of the tree, each branch being cut back several feet.

The bearing habits of bush fruits differ widely, the various kinds requiring individual treatment. Blackberries, raspberries, and dewberries bear on canes of the preceding year. Their pruning consists in: (1) removing superfluous shoots from the base of the plant, leaving 5–6 canes; (2) heading back the shoots when they are 2½–3 feet high, causing them to become stocky and throw out laterals; (3) heading back these laterals to 12–20 inches in length early in the spring before growth starts; (4) cutting out the canes soon after harvesting the fruit.

The canes of currants and gooseberries bear several times, but the first two or three crops are the best. It is therefore desirable each year after the plants have come into bearing to cut one or more of the oldest canes and to encourage new ones. Neglecting the removal of old canes leads to production of small fruit, induces taller growth, and encourages

the ravages of the currant borer. Too vigorous a growth may be headed back.

To understand grape pruning it is essential to know that: (1) the fruit is borne on wood of the present season; (2) a vine should bear only a limited number of clusters—30–80, depending upon the variety; (3) the bearing wood should be kept near the original trunk or head of the vine, otherwise the fruit will be borne further and further from the main trunk. The current systems of pruning renew to a head or main trunk each year. The trunk is carried up to the top of the trellis and two canes are taken from the top each year, their length varying from 6 to 12 nodes, depending upon the variety. A renewal cane is grown each year near the head, so that the old canes may be cut out yearly, thus keeping the fruit always near the trunk. Grape pruning should be done during the winter or early spring before the flow of sap so as to prevent "bleeding".

ADDITIONAL GIFT OF ORCHIDS BY MR. D. S. BROWN

An account of the donation to the Missouri Botanical Garden by Mr. D. S. Brown, of orchids, ferns, palms, etc. was given in the May, 1918, number of the BULLETIN. At that time it was stated that Mr. Brown's gift placed the Garden in possession of the most complete collection of orchids in the United States, comprising, exclusive of the cypripediums, 691 species. Recently Mr. Brown has decided to present to the Garden the remainder of his orchid collection consisting of cypripediums and selenipediums and including many rare and beautiful specimens which could only be duplicated with the greatest difficulty, if at all. Through the generous public spirit of Mr. Brown the Missouri Botanical Garden will now be able to display these wonderful plants as never before. The entire collection of orchids now at the Garden includes 1,235 species and varieties, which, with many duplicates of the more common forms, makes a total of 5,732 plants.

PAPHIOPEDILUMS (CYPRIPEDIUMS) AND PHRAGMOPEDILUMS (SELENIPEDIUMS) IN GARDEN COLLECTION

(Nomenclature that of Rolfe and Hurst, The Orchid Stud Book, and Sander's Orchid Guide.)

Paphiopedilum × *Aasenii* (*Fairieanum* × *Swanianum* ♀)* G.H.[1]
P. × *Abraham Lincoln* (× *Niobe* × *orphanum*)* G.H.

*Gift of D. S. Brown.
[1] G.H.=Garden hybrid.

P. × *Actaeus* (*insigne* × *Leeanum*)* G.H.
P. × *Actaeus Bianca* (*insigne Sanderae* × *Leeanum Prospero*)* G.H.
P. × *Actaeus Bianca Sander's var.* (*insigne Sanderae* × *Leeanum Prospero*)* G.H.
P. × *Actaeus gigantea* (*insigne* × *Leeanum*)* G.H.
P. × *Actaeus langleyensis* (*insigne Sanderae* × *Leeanum*)* G.H.
P. × *Actaeus langleyensis var.* (*insigne Sanderae* × *Leeanum superbum*)* G.H.
P. × *Actaeus superba* (*insigne* × *Leeanum*)* G.H.
P. × *Actaeus var.* (*insigne* × *Leeanum*)* G.H.
P. × *Actaeus var.* (*insigne Chantinii* × *Leeanum*)* G.H.
P. × *Actaeus var.* (*insigne Harefield Hall* × *Leeanum Clinkaberryanum*)* G.H.
P. × *Actaeus var.* (*insigne Sanderae* × *Leeanum aureum*)* G.H.
P. × *Actaeus var.* (*insigne Sanderianum* × *Leeanum Prospero*)* G.H.
P. × *Adonis* (*Curtisii* × *hirsutissimum*) G.H.
P. × *Alcides* (*insigne* × *hirsutissimum*) G.H.
P. × *allertonense* (*bellatulum* × *villosum*)* G.H.
P. × *Almum* (*barbatum* × *Lawrenceanum*) G.H.
P. × *amabile* (*Hookerae* × *Sementa*) G.H.
P. × *Amesiae* (*Fairieanum* × *tonsum* ♀)* G.H.
P. × *Andonicus* (*Rothschildianum* × *Victoria Marie*)* G.H.
P. × *Antigone* (*Lawrenceanum* × *niveum*)* G.H.
P. × *apiculatum* (*barbatum* × *Boxallii*) G.H.
P. × *Arethusa* (× *Milo* × *nitens*)* G.H.
*P. Argus,** Philippines
*P. Argus moense,** Philippines
P. × *Artemis* (*Dayanum* × *Swanianum*) G.H.
P. × *Arthurianum* (*Fairieanum* × *insigne*)* G.H.
P. × *Arthurianum pulchellum* (*Fairieanum* × *insigne Chantinii*)* G.H.
P. × *Arthurianum pulchellum giganteum* (*Fairieanum* × *insigne Chantinii*)* G.H.
P. × *Arthurianum pulchellum Harrisii* (*Fairieanum* × *insigne Chantinii*)* G.H.
P. × *Ashburtoniae* (*barbatum* × *insigne*)* G.H.
P. × *Ashburtoniae expansum* (*barbatum* × *insigne*)* G.H.
P. × *Ashburtoniae Laforcadei* (*barbatum* × *insigne Chantinii*)* G.H.
P. × *Astrae* (*philippinense* × *Spicerianum*) G.H.
P. × *Atlas* (× *Ceres* × *insigne*)* G.H.
P. × *augustum* (*Lawrenceanum* × *superciliare*)* G.H.
P. × *aureum album* (× *nitens* × *Spicerianum*)* G.H.
P. × *aureum Augusta* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.
P. × *aureum Cyrus* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.
P. × *aureum distinct* (× *nitens* × *Spicerianum*)* G.H.
P. × *aureum Hyeanum* (× *nitens* × *Spicerianum*)* G.H.
P. × *aureum Hyeanum giganteum* (× *nitens* × *Spicerianum*)* G.H.
P. × *aureum Oedippe* (× *nitens Sallierii Hyeanum* × *Spicerianum magnificum*)* G.H.
P. × *aureum Prospero* (× *nitens* × *Spicerianum*)* G.H.
P. × *aureum Surprise* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.
P. × *aureum var.* (× *nitens Sallierii* × *Spicerianum*)* G.H.
P. × *aureum var.* (× *nitens superba* × *Spicerianum*)* G.H.
P. × *aureum var.* (× *nitens superbum* × *Spicerianum magnificum*)* G.H.
P. × *aureum Vertumnae* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.

P. × *aureum virginale* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.
P. × *aureum virginale magnificum* (× *nitens Sallierii Hyeanum* × *Spicerianum*)* G.H.
P. × *Bagshaweae* (*callosum* × *oenanthum* ♀)* G.H.
P. × *Ballantinei* (*Fairieanum* × *purpuratum*)* G.H.
*P. barbatum,** Java
P. barbatum Crossii, Java
P. barbatum Hendersoni, Java
P. barbatum illustre, Java
P. barbatum Mosaicum, Java
P. × *Barbeyae* (*Lawrenceanum* × *tonsum*) G.H.
P. × *Beatrice* (*Boxallii* × *Lowii*)* G.H.
P. × *Behrensianum* (*Boxallii* × *Io grande*)* G.H.
P. × *Bella Sander's var.* (*philippinense* × *vexillarium*)* G.H.
P. × *Benita* (*aureum* × *Maudiae*)* G.H.
P. × *bingleyense* (*Charlesworthii* × *Harrisianum*)* G.H.
P. × *bingleyense splendens* (*Charlesworthii* × *Harrisianum*)* G.H.
P. × *Black Watch* (*Curtisii Sander's var.* × *W. R. Lee*)* G.H.
*P. Boxallii,** Moulmein
*P. Boxallii aureum,** Moulmein
P. × *Brandtiae* (× *Io grande* ♀ × *Youngianum*)* G.H.
P. × *Brandtiae Rothwell var.* (× *Io grande* ♀ × *Youngianum*)* G.H.
P. × *Brunhild* (× *Lathamianum* × *Victoria Marie*)* G.H.
P. × *Bruno* (× *Leeanum* × *Spicerianum*)* G.H.
P. × *Bruno Keeling's var.* (× *Leeanum* × *Spicerianum*)* G.H.
P. × *Buchanianum* (*Druryi* × *Spicerianum*) G.H.
P. × *Buckinghami* (*bellatulum* × *enfieldense* ♀)* G.H.
P. × *Bullieri* (*tonsum* × *villosum*)* G.H.
P. × *Cahuzacii* (*pavoninum* × *villosum*) G.H.
P. × *calloso-Argus* (*Argus* × *callosum*) G.H.
P. × *calloso-Rothschildianum* (*callosum* × *Rothschildianum*)* G.H.
*P. callosum,** Burma
*P. callosum Browniae,** Burma
*P. callosum giganteum,** Burma
*P. callosum Sanderae,** Burma
*P. callosum Sanderae Jules Hye's var.,** Burma
P. calophyllum (*barbatum* × *venustum*)* G.H.
P. × *Calypso* (*Boxallii* × *Spicerianum*)* G.H.
P. × *Calypso illustre* (*Boxallii* × *Spicerianum*)* G.H.
P. × *Calypso Oakwood var.* (*Boxallii atratum* × *Spicerianum*)* G.H.
P. × *Calypso var.* (*Boxallii* × *Spicerianum*)* G.H.
P. × *Calypso var.* (*Boxallii grande* × *Spicerianum*)* G.H.
P. Canhami (*superbiens* ♀ × *villosum*)* G.H.
P. × *Caruso* (× *J. Howes* × *insigne Harefield Hall*)* G.H.
P. × *Ceres* (*hirsutissimum* × *Spicerianum*)* G.H.
P. × *Ceres fascinator* (*hirsutissimum* × *Spicerianum*)* G.H.
P. × *Ceres superba* (*hirsutissimum* × *Spicerianum*)* G.H.
*P. Chamberlainianum,** Sumatra
P. × *Chapmaniae* (× *Calypso* × *Fairieanum*)* G.H.
*P. Charlesworthii,** Burma
P. × *Charlesworthii* Brownhurst seedling* G.H.
*P. Charlesworthii splendens,** Burma
*P. Charlesworthii Westfield var.,** Burma
P. × *chloroneurum* (× *Harrisianum* × *venustum*) G.H.
*P. ciliolare,** Philippines
*P. ciliolare superba,** Philippines
P. × *Clarkii* (× *Fairieanum* × *Harrisianum*)* G.H.
P. × *Clinkaberryanum* (*Curtisii* × *philippinense*)* G.H.

P. × *Clio* (*insigne* × *Lynchianum*) G.H.
P. × *Clio var.* (*insigne Chantinii* × *Lynchianum*)* G.H.
P. × *Colmanii nigrum* (× *Harrisianum* × *javanicum* ♀) G.H.
P. × *Comus var.* (*insigne Ernesti* × *Swanianum*)* G.H.
P. × *Comus var.* (*insigne Sanderae* × *Swanianum*)* G.H.
P. × *concinnum* (*purpuratum* × *Harrisianum*)* G.H.
P. × *concinnum superbum* (*purpuratum* × *Harrisianum*)* G.H.
P. × *concinnum transparent* (*purpuratum* × *Harrisianum*)* G.H.
P. concolor, Burma
P. × *Connie* (*Fairieanum* × *glaucophyllum*)* G.H.
P. × *conspicuum* (× *Harrisianum* × *villosum*)* G.H.
P. × *conspicuum Prewettii* (× *Harrisianum* × *villosum*)* G.H.
P. × *Constance* (*Curtisii* ♀ × *Stonei*) G.H.
P. × *Constance James H. Veitch exquisetum* (*Curtisii* × *Stonei platytaenium*)* G.H.
P. × *Constance James H. Veitch exquisetum var.* (*Curtisii* × *Stonei platytaenium*)* G.H.
P. × *Cravenianum* (× *Hera* ♀ × *Spicerianum*)* G.H.
P. × *Creon* (× *Harrisianum* × *oenanthum*)* G.H.
P. × *Creon var.* (× *Harrisianum* × *oenanthum*)* G.H.
P. × *Crossianum* (*insigne* × *venustum*) G.H.
P. × *Crossianum Maud Adams* (*insigne Sanderae* × *venustum Measuresianum*)* G.H.
P. × *Crossianum Tautzianum* (*insigne* × *venustum*)* G.H.
P. × *Crossianum var.* (*insigne Sanderianum* × *venustum Measuresianum*)* G.H.
P. × *Monsieur de Curte* (*Boxallii* × *insigne*)* G.H.
P. Curtisii,* Sumatra
P. Curtisii exquisetum,* Sumatra
P. × *Cymatodes beechense superbum* (*Curtisii* ♀ × *superbiens Demidoff's var.*)* G.H.
P. × *Cyris* (*Argus* × *Boxallii*)* G.H.
P. × *Cythera* (*purpuratum* × *Spicerianum*) G.H.
P. × *Daphne* (*Charlesworthii* × *Exul*)* G.H.
P. Dayanum,* Borneo
P. × *decipiens* (*Charlesworthii* × *Lawrenceanum*)* G.H.
P. × *decorum* (*Lawrenceanum* × *nitens*) G.H.
P. × *Deedmannianum* (*Chamberlainianum* × *Spicerianum* ♀)* G.H.
P. × *Dido* (*Sanderianum* × *selligerum* ♀)* G.H.
P. × *Dimmocki* (× *Godseffianum* × *Druryi*) G.H.
P. × *Doncasterianum* (*callosum* × *hirsutissimum*) G.H.
P. × *Dowleri* (*Godefroyae* × *insigne*)* G.H.
P. × *Dowleri Hindeanum* (*Godefroyae leucochilum* × *insigne Harefield Hall*)* G.H.
P. × *Dreadnought* (*insigne Harefield Hall* × *Troilus*)* G.H.
P. Druryi,* S. India
P. × *Durbar* (*hirsutissimum* × *Morganiae*)* G.H.
P. × *Earl* (× *oenanthum superbum* × *selligerum majus*)* G.H.
P. × *Edwardii superbum* (*Fairieanum* × *superbiens* ♀)* G.H.
P. × *Eismannianum* (*Boxallii* × *Harrisianum*) G.H.
P. × *Elsie* (*Boxallii* × *Charlesworthii*)* G.H.
P. × *enfieldense* (*Hookerae* × *Lawrenceanum*) G.H.
P. × *Euryale* (*Lawrenceanum* × *superbiens*)* G.H.
P. × *Euryale inversum* (*Lawrenceanum* × *superbiens*) G.H.
P. × *euryandrum* (*barbatum* ♀ × *Stonei*)* G.H.
P. × *Evelyn* (× *Calypso* × *Leeanum*)* G.H.
P. Exul,* Siam
P. × *Fairy Queen* (*Curtisii* ♀ × *Druryi*)* G.H.
P. Fairieanum,* Assam

*P. Fairieanum extra,** Assam
P. × *Felicity* (*callosum* × *tonsum*)* G.H.
P. × *Figaro* (*oenanthum* × *Spicerianum* ♀)* G.H.
P. × *Fitchianum* (*Bullenianum* × *venustum*)* G.H.
P. × *Fowlerae* (× *Chamberlainianum* × *insigne*) G.H.
P. × *G. F. Moore* (× *Mrs. Wm. Mostyn* × *nitens*) G.H.
P. × *Garfieldii* (× *regale* × *tonsum*) G.H.
P. × *Gaston Bultel* (*Fairieanum* × *Mad. Coffinet*)* G.H.
P. × *Gayotiae* (*Dayanum* ♀ × *insigne*) G.H.
P. × *Gem* (*insigne* × *marmorophyllum* ♀)* G.H.
P. × *Germaine Opoix* (*Fairieanum* × *Mad. Coffinet*)* G.H.
P. × *Germinyanum* (*hirsutissimum* × *villosum*)* G.H.
P. × *gigas* (× *Harrisianum* × *Lawrenceanum* ♀)* G.H.
P. × *gigas Corndean Hall* (× *Harrisianum* × *Lawrenceanum*)* G.H.
P. × *gigas Corndean Hall var.* (× *Harrisianum* × *Lawrenceanum*)* G.H.
P. × *gigas splendens* (× *Harrisianum* × *Lawrenceanum*)* G.H.
*P. glaucophyllum,** Java
P. × *Gowerianum* (*Curtisii* × *Lawrenceanum*)* G.H.
P. × *Gowerianum magnificum Schofield var.* (*Curtisii* × *Lawrenceanum*)* G.H.
P. × *Gravesii* (*Lawrenceanum* × *Marshallianum*)* G.H.
P. × *Greyanum* (*ciliolare* ♀ × *Druryi*)* G.H.
P. × *Grovesianum* (× *Lathamianum* × *Leeanum*)* G.H.
P. × *Hansenii* (*Haynaldianum* × *villosum*)* G.H.
P. × *Harrisianum* (*barbatum* × *villosum* ♀)* G.H.
P. × *Harrisianum albescens* (*barbatum* × *villosum* ♀)* G.H.
P. × *Harrisianum extra dark var.* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum luteola* (*barbatum* × *villosum* ♀)* G.H.
P. × *Harrisianum luteum* (*barbatum* × *villosum*) G.H.
P. × *Harrisianum magnificum* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum marginale* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum marmoratum* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum negro* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum nigrum* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum Pitcherianum* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum splendens* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum superbum* (*barbatum* × *villosum*)* G.H.
P. × *Harrisianum tenue* (*barbatum* × *villosum*) G.H.
P. × *Harrisianum var.* (*barbatum* × *villosum*)* G.H.
P. × *Harveyanum* (*Leeanum* × *Stonei*) G.H.
*P. Haynaldianum,** Philippines
P. × *Haywoodianum* (*Druryi* × *superbiens* ♀)* G.H.
P. × *Hera* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera Adrastus* (*Boxallii* × *Leeanum*) G.H.
P. × *Hera Brownii* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera Brownii* × stray seedling* G.H.
P. × *Hera Euryades* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera Euryades Black Prince* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera Euryades splendens* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera Euryades var.* (*Boxallii* × *Leeanum*)* G.H.
P. × *Hera var.* (*Boxallii* × *Leeanum Clinkaberryanum*)* G.H.
*P hirsutissimum**
P. × *Holdenii* (*callosum Sanderae* × *Maudiae*)* G.H.
P. × *Hornerianum* (*Spicerianum* × *superbiens*) G.H.
P. × (× *Actaeus* × *nitens*)* G.H.
P. × (× *Actaeus* × *nitens Sallierii*)* G.H.
P. × (× *aureum Hyeanum* × *Spicerianum*)* G.H.
P. × (× *aureum virginale* × *Black Empress*)* G.H.

P. × (× *aureum virginale* × *glaucophyllum*)* G.H.
P. × (*Boxallii* × ?)* G.H.
P. × (*Boxallii* × *Evelyn*)* G.H.
P. × Brownhurst stray seedlings* G.H.
P. × (× *calophyllum* × *villosum*)* G.H.
P. × (× *calophyllum* × *villosum aureum*)* G.H.
P. × (× *Calypso* × *Gem*)* G.H.
P. × (× *Calypso* × *Exul*)* G.H.
P. × (× *Ceres superbum* × *Maudiae*)* G.H.
P. × (× *Charlesworthii* × ?) G.H.
P. × (*Curtisii exquisetum* × *Mons de Ant*)* G.H.
P. × (× *Deedmannianum* × *Spicerianum*)* G.H.
P. × (× *D. S. Brown* × *callosum*)* G.H.
P. × (*Fairieanum* × *Lityas*?)* G.H.
P. × (*Fairieanum* × *Hitchinsiae*)* G.H.
P. × (*Fairieanum* × *Mad. Jules Hye*)* G.H.
P. × (*Fairieanum* × *Niobe Oakwood var.*)* G.H.
P. × (*Fairieanum* × *Niobe Oakwood Mad. Jules Hye*)* G.H.
P. × (*Fairieanum* × *Princess*)* G.H.
P. × (*Fitchianum* × *venustum*)* G.H.
P. × (× *gigas* × *villosum*)* G.H.
P. × (×*Golden Queen* × *Lathamianum Exul*)* G.H.
P. × (*Haynaldianum* × *nitens*)* G.H.
P. × (*insigne* × ?)
P. × (*insigne Eirmanianum* × *nitens* × *Leeanum*)* G.H.
P. × (*insigne Sanderae* × *Bonhoffianum*)* G.H.
P. × (*insigne Sanderae* × *Matthewsii*)* G.H.
P. × (*insigne Sanderae* × *Sallierii Hyeanum*)* G.H.
P. × (*insigne* Sander's seedling × *Golden Queen*)* G.H.
P. × (× *Lathamianum* × *Golden Queen*)* G.H.
P. × (× *maculatum*? × *villosum de Paris*)* G.H.
P. × (× *Measuresianum* × *nitens*)* G.H.
P. × *Mad. Jules Hye* (*Spicerianum* × *tonsum*)* G.H.
P. × *Ilene* (*glaucophyllum* × *insigne Sanderae*)* G.H.
P. × *illustre* (× *Lathamianum* × *nitens*)* G.H.
P. × *illustre var.* (× *Lathamianum* × *nitens green var.*)* G.H.
P. × *Imperatrix* (× *Ashburtoniae* × *calophyllum*)* G.H.
P. × *ingens* (*insigne* × *Rothschildianum*)* G.H.
P. × *ingens var.* (*insigne Harefield Hall* × *Rothschildianum*)* G.H.
P. insigne,* N. India
P. insigne Admiral Togo, N. India
P. insigne Ashfield var., N. India
P. insigne aureum giganteum,* N. India
P. insigne Bisepalae superbum Albertonense,* N. India
P. insigne Black Prince,* N. India
P. insigne Bonhoffianum,* N. India
P. insigne Brownii, N. India
P. insigne Brugens,* N. India
P. insigne Caulsonianum, N. India
P. insigne Chantinii, N. India
P. insigne Chantinii × *P. insigne Harefield Hall*,* N. India
P. insigne Chantinii Lindeni,* N. India
P. insigne citrinum,* N. India
P. insigne corrugata, N. India
P. insigne Cowleyanum,* N. India
P. insigne Dominianum,* N. India
P. insigne Dorothy,* N. India
P. insigne D. S. Brown,* N. India
P. insigne Eirmanianum,* N. India

*P. insigne equator,** N. India
*P. insigne Ernestii,** N. India
*P. insigne F. W. Moore,** N. India
*P. insigne G. B. Wilson,** N. India
*P. insigne giganteum,** N. India
*P. insigne Golden Queen,** N. India
*P. insigne Golden var.,** N. India
*P. insigne Harefield Hall,** N. India
*P. insigne Heatonense,** N. India
P. insigne × *insigne* No. 500* G.H.
*P. insigne Kathleen Corsar,** N. India
*P. insigne King Edward VII,** N. India
*P. insigne Lagerae,** N. India
*P. insigne Laura Kimball,** N. India
*P. insigne Lindenae,** N. India
P. insigne Lindeni, N. India
*P. insigne lucianum,** N. India
*P. insigne Ludwigianum,** N. India
*P. insigne Macfarlanae,** N. India
*P. insigne Monarch Prewett's var.,** N. India
*P. insigne Monk's Hood,** N. India
*P. insigne Mrs. D. S. Brown,** N. India
*P. insigne Mrs. G. B. Wilson,** N. India
*P. insigne negro,** N. India
*P. insigne R. H. Measures,** N. India
*P. insigne Roebelenii,** N. India
P. insigne Rothschildianum, N. India
*P. insigne Sanderae,** N. India
P. insigne Sanderae seedling,* N. India
*P. insigne Sanderianum,** N. India
*P. insigne splendens,** N. India
*P. insigne Sylhetense giganteum,** N. India
*P. insigne Sylhetense Monarch,** N. India
*P. insigne tonbridgense,** N. India
*P. insigne violaceum,** N. India
*P. insigne Wellsiana,** N. India
*P. insigne var.,** N. India
P. × *Io* (*Argus* × *Lawrenceanum*)* G.H.
P. × *Io grande* (*Argus* × *Lawrenceanum*)* G.H.
*P. javanicum,** Java
*P. javanicum green var.,** Java
*P. javanicum superbum,** Java
P. × *Johnsonianum* (*Lawrenceanum* × *nitens*)* G.H.
P. × *Johnsonianum var.* (*Lawrenceanum* × *nitens superbum*)* G.H.
P. × *Josephianum* (*Druryi* × *Sementa*)* G.H.
P. × *Kenneth* (× *Calypso* × *hirsutissimum*)* G.H.
P. × *Kerchoveanum* (*barbatum* × *Curtisii*)* G.H.
P. × *Kerchoveanum var.* (*barbatum nigrum* × *Curtisii*)* G.H.
P. × *Lairessei* (*Curtisii* × *Rothschildianum*)* G.H.
P. × *Lamonteanum* (× *Calypso* × *Rothschildianum*)* G.H.
P. × *Lathamianum* (*Spicerianum* × *villosum*)* G.H.
P. × *Lathamianum Hillii* (*Spicerianum* × *villosum*)* G.H.
P. × *Lathamianum inversum* (*Spicerianum* × *villosum*) G.H.
*P. Lawrenceanum,** Borneo
*P. Lawrenceanum Hyeanum,** Borneo
*P. Lawrenceanum Mastersianum,** Borneo
*P. Lawrenceanum The King,** Borneo
*P. Lawrenceanum Veitchii,** Borneo
P. × *Leander* (× *Leeanum* × *villosum*)* G.H.

P. × *Leander var.* (× *Leeanum aureum* × *villosum*)* G.H.
P. × *Ledouxiae* (*callosum* × *Harrisianum*) G.H.
P. × *W. R. Lee var. Lord Derby* (*Rothschildianum* × *superbiens*)* G.H.
P. × *Leeanum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Albert Hye* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Albertianum* (*insigne Wallacei* × *Spicerianum*) G.H.
P. × *Leeanum aureum* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum Burford Lodge* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum Clinkaberryanum* (*insigne Harefield Hall* × *Spicerianum*)* G.H.
P. × *Leeanum Clinkaberryanum South Orange var.* (*insigne* × *Spicerianum*)*
P. × *Leeanum Engelhardtiae* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum erectum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum giganteum* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum green var.* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum G. S. Ball's var.* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Keeling's var.* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum lutescens* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum magnificum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Mary Clinkaberry* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Masreellianum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Measuresianum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum Prospero* (*insigne Sanderae* × *Spicerianum*)* G.H.
P. × *Leeanum Prospero var.* (*insigne Sanderae* × *Spicerianum*)* G.H.
P. × *Leeanum pulchellum* (*insigne* × *Spicerianum*) G.H.
P. × *Leeanum rubrum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum South Orange var.* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum superbum* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum var.* (*insigne* × *Spicerianum*)* G.H.
P. × *Leeanum var.* Brownhurst seedling (*insigne* × *Spicerianum*)* G.H.
P. × *Leoniae* (*callosum* × *insigne*)* G.H.
P. × *Leoniae var.* (*callosum* × *insigne Sanderae*)* G.H.
P. × *Leoniae var.* (*callosum* × *insigne yellow*)* G.H.
P. × *loochristiense* (× *Harrisianum* × *Hookerae*)* G.H.
P. Lowii, Borneo
P. × *Lumsdenii* (*barbatum* × *Charlesworthii*)* G.H.
P. × *luridum* (*Lawrenceanum* × *villosum*)* G.H.
P. × *Mabeliae* (*Rothschildianum* × *superbiens*) G.H.
P. × *Macfarlanianum* (*Lawrenceanum* × *Lowii*) G.H.
P. × *macropterum* (*Lowii* × *superbiens*) G.H.
P. × *Madeline* (*Argus* × *bellatulum*)* G.H.
P. × *Madiotianum* (*Chamberlainianum* × *villosum*)* G.H.
P. × *Mahlerae* (*Lawrenceanum* × *Rothschildianum*) G.H.
P. × *Mapleae* (× *Gowerianum* × *Youngianum* ♀)* G.H.
P. × *Mary Beatrice* (*bellatulum* × *Gowerianum* ♀)* G.H.
P. × *Massaianum* (*Rothschildianum* × *superciliare*)* G.H.
P. Mastersianum,* Java
P. Mastersianum superbum,* Java
P. × *Matthews Oakdens var.* (*Lawrenceanum* × *Mastersianum*)* G.H.
P. × *Matthewsii* (*Lawrenceanum* × *Mastersianum*)* G.H.
P. × *Maudiae Dell var.* (*callosum Sanderae* × *Lawrenceanum Hyeanum*)* G.H.
P. × *Maudiae magnificum* (*callosum Sanderae* × *Lawrenceanum Hyeanum*)* G.H.
P. × *Maudiae var.* (*callosum* × *Lawrenceanum*)* G.H.
P. × *Measuresianum* (*venustum* × *villosum*)* G.H.
P. × *Measuresianum atratum* (*venustum* × *villosum*)* G.H.
P. × *Medeia superbum* (*hirsutissimum* × *Spicerianum*) G.H.

P. × ***Menelik*** (***Boxallii*** × ***Calypso***)* G.H.
P. × *Menelik var.* (*Boxallii* × *Calypso illustris* ♀)* G.H.
P. × *microchilum* (*Druryi* × *niveum*)* G.H.
P. × *Milo Westonbert var.* (*insigne* × *oenanthum*)* G.H.
P. × *Minos Lowii* (× *Arthurianum* × *Spicerianum*)* G.H.
P. × *Minos Veitchii* (× *Arthurianum* × *Spicerianum*) G.H.
P. × *Minos Youngianum giganteum* (× *Arthurianum* × *Spicerianum*)* G.H.
P. × *Minos Youngii* (× *Arthurianum* × *Spicerianum*)* G.H.
P. × ***Morganiae*** (***Stonei*** × ***superbiens***)* G.H.
P. × *Morganiae burfordiense* (*Stonei* × *superbiens*)* G.H.
P. × *Morganiae gloriosa* (*Stonei* × *superbiens*)* G.H.
P. × *Morganiae langleyense* (*Stonei* × *superbiens*)* G.H.
P. × *Myra* (*Chamberlainianum* × *Haynaldianum*)* G.H.
P. × ***Nandii*** (***callosum*** × ***Tautzianum***)* G.H.
P. × ***Nellie*** (***Charlesworthii*** × ***tonsum***) G.H.
P. × ***Niobe*** (***Fairieanum*** × ***Spicerianum***)* G.H.
P. × *Niobe* Brownhurst seedling (*Fairieanum* × *Spicerianum*)* G.H.
P. × *Niobe dark var.* Brownhurst seedling (*Fairieanum* × *Spicerianum*)* G.H.
P. × *Niobe Brownhurst var.* (*Fairieanum* × *Spicerianum*)* G.H.
P. × *Niobe* stray seedling* G.H.
P. × *Niobe giganteum* (*Fairieanum* × *Spicerianum*)* G.H.
P. × *Niobe-Leeanum* (× *Leeanum* × *Niobe*)* G.H.
P. × *Niobe nigrum* (*Fairieanum* × *Spicerianum*)* G.H.
P. × *Niobe Westonbert var.* (*Fairieanum* × *Spicerianum*)* G.H.
P. × ***nitens*** (***insigne*** × ***villosum***)* G.H.
P. × *nitens Almos* (*insigne* × *villosum aureum* ♀)* G.H.
P. × *nitens Arlecourt var.* (*insigne* × *villosum*)* G.H.
P. × *nitens Great Rex* (*insigne Sanderae* × *villosum*)* G.H.
P. × *nitens Great Rex var.* (*insigne yellow* × *villosum*)* G.H.
P. × *nitens Leeanum* (× *Leeanum* × *nitens*)* G.H.
P. × *nitens Leeanum var.* (× *Leeanum giganteum* × *nitens*)* G.H.
P. × *nitens Leeanum var.* (*nitens superbum* × *Leeanum*)* G.H.
P. × *nitens magnificum* (*insigne* × *villosum*)* G.H.
P. × *nitens Olympia* (*insigne* × *villosum* ♀)* G.H.
P. × *nitens Prince Olaf* (*insigne* × *villosum*)* G.H.
P. × *nitens Sallierii* (*insigne* × *villosum* ♀)* G.H.
P. × *nitens Sallierii Hyeanum* (*insigne* × *villosum*)* G.H.
P. × *nitens Sallierii pictum* (*insigne* × *villosum*)* G.H.
P. × *nitens Sallierii platypetalum* (*insigne* × *villosum* ♀)* G.H.
P. × *nitens Sander's var.* (*insigne* × *villosum*)* G.H.
P. × ***nitens var.*** (***insigne*** × ***villosum***)* G.H.
P. × *nitens var.* (*insigne Sanderae* × *villosum aureum*)* G.H.
P. ***niveum,**** Tambelan Islands
P. × *oenanthum* (*Harrisianum* × *insigne*)* G.H.
P. × *oenanthum De Wittsmith var.* (× *Harrisianum* × *insigne*)* G.H.
P. × *oenanthum porphyreum* (× *Harrisianum* × *insigne*)* G.H.
P. × *oenanthum superbum* (× *Harrisianum* × *insigne*)* G.H.
P. × ***Olivia*** (***niveum*** × ***tonsum*** ♀)* G.H.
P. × ***Orion*** (***concolor*** × ***insigne***)* G.H.
P. × *orphanum superbum* (*barbatum* × *Druryi*)* G.H.
P. × ***Orpheus*** (***callosum*** × ***venustum***) G.H.
P. × *Our King* (× *Leeanum* × *Stevensii*)* G.H.
*P. Parishii,** Burma
P. × *pavoninum* (*Boxallii* × *venustum*)* G.H.
P. × *Phoebe* (*bellatulum* × *philippinense*)* G.H.
P. × *Pitcheri* (*barbatum* × *purpuratum*) G.H.
P. × *Pitcherianum* (× *Harrisianum* × *Spicerianum*) G.H.

P. × *Pluto* (*Boxallii* × *calophyllum*)* G.H.
P. × *Polkii* (*Chamberlainianum* × *nitens*)* G.H.
P. × *Pollettianum* (× *calophyllum* × *oenanthum*) G.H.
P. × *polystigmaticum* (*Spicerianum* × *venustum*) G.H.
P. × *Priam* (*insigne* × *Niobe*)* G.H.
P. × *Princess* (*Coffinetii* × *Fairieanum*)* G.H.
P. × *Queen Mary* (× *Aeson* × *insigne Harefield Hall*)* G.H.
P. × *radiosum shorthilliense* (*Lawrenceanum* × *Spicerianum*)* G.H.
P. × *regale* (*insigne* × *purpuratum*)* G.H.
P. × *regale superbum* (*insigne* × *purpuratum*)* G.H.
P. × *Regina var.* (*Fairieanum* × *Leeanum Albertianum* ♀)* G.H.
P. × *Regina extra* (*Fairieanum* × *Leeanum Albertianum*)* G.H.
P. × *Reynaldi* (*Boxallii* × *villosum* ♀) G.H.
P. × *Richmanii* (*barbatum* × *bellatulum*)* G.H.
P. × *Rolfei* (*bellatulum* × *Rothschildianum*)* G.H.
P. × *Rosita* (*callosum* × *Charlesworthii*)* G.H.
P. × *Rosita Stanley Rogerson* (*callosum* × *Charlesworthii*)* G.H.
P. × *Rossetti* (*insigne Sanderianum* × *Maudiae*)* G.H.
*P. Rothschildianum,** Borneo
P. × *Rufus* (*insigne Macnabianum* × *Milo*)* G.H.
P. × *St. Albans* (× *Aphrodite* × *Harrisianum*)* G.H.
P. × *Salomonae* (× *Lathamianum* × *Spicerianum*)* G.H.
P. × *Sanarthur var.* (× *Arthurianum* × *insigne Sanderae*)* G.H.
P. × *Sanderiano-Curtisii* (*Curtisii* × *Sanderianum*)* G.H.
P. × *Sanderiano-superbiens* (*Sanderianum* × *superbiens*)* G.H.
P. × *Schlesingerianum* (*Boxallii* × *insigne*) G.H.
P. × *Schroederi* (*Fairieanum* × *oenanthum*) G.H.
P. × *Schroederi Sander's var.* (*Fairieanum* × *oenanthum*)* G.H.
P. × *selligerum* (*barbatum* × *philippinense*)* G.H.
P. × *selligerum majus* (*barbatum* × *philippinense*)* G.H.
P. × *selligerum porphyreum* (*barbatum* × *philippinense*)* G.H.
P. × *selligerum rubrum* (*barbatum* × *philippinense*) G.H.
P. × *Seymouri* (*callosum* × *gigas?*)* G.H.
P. × *Simonii* (*insigne* × *Leeanum*)* G.H.
P. × *Simonii inversum* (*insigne* × *Leeanum*)* G.H.
P. × *Smithianum* (*callosum* × *Druryi*) G.H.
P. × *Solon* (*Rothschildianum* × *tonsum*)* G.H.
P. Spicerianum, Assam
*P. Spicerianum giganteum,** Assam
P. Spicerianum var., Assam
P. × *Spicero-niveum* (*niveum* × *Spicerianum*) G.H.
*P. Stonei,** Borneo
*P. Stonei superbum,** Borneo
P. sublaeve, Siam
*P. superbiens,** Trop. Asia
P. × *superciliare* (*barbatum* × *superbiens*)* G.H.
P. × *Sutherlandiae* (*Rothschildianum* × *Youngianum*) G.H.
P. × *Swanianum* (*barbatum* × *Dayanum*)* G.H.
P. × *Talisman* (× *nitens* × *Harrisianum*) G.H.
P. × *Tankervillei* (*Exul* × *nitens Sander's var.*)*
P. × *Thalia Mrs. Francis Wellesley* (*Baron Schroeder* × *insigne*)* G.H.
P. × *Thayerianum* (*Boxallii* × *Lawrenceanum*)* G.H.
P. × *Thompsonii* (× *Calypso* × *villosum*)* G.H.
*P. tonsum,** Sumatra
P. × *Transvaal* (*Chamberlainianum* × *Rothschildianum*)* G.H.
P. × *tringiense* (*barbatum* × *Rothschildianum*)* G.H.
P. × *triumphans* (× *nitens Sallierii* × *oenanthum superbum*)* G.H.
P. × *Troilus* (*insigne* × *nitens*)* G.H.
P. × *Troilus Oakden var.* (*insigne* × *nitens*)* G.H.

P. × *Troilus Oakwoodense var.* (*insigne* × *nitens*)* G.H.
P. × *Ultor* (*Lawrenceanum* × *Sanderianum*)* G.H.
P. × *Umlauftianum* (*insigne* × *Lawrenceanum*) G.H.
P. × *Vacuna* (*Rothschildianum* × *villosum*)* G.H.
P. × *venubel* (*bellatulum* × *venustum*)* G.H.
P. × *Venus Boltoni* (*insigne Sanderae* × *niveum*)* G.H.
P. × *Venus Ram Lee var.* (*insigne Sanderae* × *niveum*)* G.H.
*P. venustum Measuresianum,** Himalaya
P. venustum spectabile, N. India
P. × *vernixium* (*Argus* × *villosum*)* G.H.
P. × *Veronica* (*Fairieanum* × *Mad. Octave Opoix*)* G.H.
P. × *vexillarium* (*barbatum* × *Fairieanum*)* G.H.
P. × *vexillarium superbum* (*barbatum* × *Fairieanum*)* G.H.
P. Victoria Marie, Sumatra
*P. villosum,** Burma
*P. villosum Bonhoffianum,** Burma
*P. villosum giganteum,** Burma
*P. villosum Grand Monarch,** Burma
*P. villosum nigrum,** Burma
*P. villosum Norman var.,** Burma
*P. villosum platypetalum,** Burma
P. × *Vipanii* (*niveum* × *philippinense*)* G.H.
*P. volontianum Rothschildianum,** Borneo
P. × *Wendigo* (*callosum* × *nitens*) G.H.
P. × *Wiertzianum* (*Lawrenceanum* × *Rothschildianum*)* G.H.
P. × *Winnianum* (*Druryi* × *villosum*)* G.H.
P. × *Youngianum* (*philippinense* × *superbiens*)* G.H.
P. × *Zampa* (*hirsutissimum* × *Leeanum* ♀)* G.H.
P. × *Zampa var.* (*hirsutissimum var.* × *Leeanum superbum* ♀)* G.H.

Phragmopedilum × *Ainsworthii* (*longiflorum* × *Sedenii*) G.H.
P. × *Ainsworthii Rogersii* (*longifolium* × *Sedenii*)* G.H.
P. × *Brownhurst* (*calurum* × *Sargentianum*)* G.H.
P. × *cardinale* (*Schlimii* × *Sedenii*) G.H.
P. × *Cleola* (× *Boissieranum* × *Schlimii*) G.H.
P. × *conchiferum* (*caricinum* × *longifolium*) G.H.
P. × *Coppinianum* (*conchiferum* × *Sedenii* ♀) G.H.
P. × *Geralda* (*caudatum* × *Lindleyanum* ♀)* G.H.
P. × *giganteum Gottianum* (*caudatum* × *grande macrochilum*)* G.H.
P. × *grande* (*caudatum* × *longifolium* ♀)* G.H.
P. × *grande atratum* (*caudatum* × *longifolium Hartwegii*)* G.H.
P. × *grande macrochilum* (*caudatum Lindeni* × *longifolium*)* G.H.
P. × *Hardyanum* (*calurum* × *caudatum*) G.H.
*P. Lindleyanum,** British Guiana
P. longifolium, Central America
P. longifolium Hartwegii, Central America
P. × *L'Unique* (*Lindleyanum* × *Schlimii albiflorum*)* G.H.
P. × *nitidissimum* (*caudatum* × *conchiferum*) G.H.
P. × *Perseus* (*Lindleyanum* × *Sedenii* ♀)* G.H.
P. Roezlii, Guiana
P. × *Schroederae* (*caudatum* × *Sedenii*)* G.H.
P. × *Schroederae splendens* (*caudatum roseum* × *Sedenii*)* G.H.
P. × *Sedenii* (*longifolium* × *Schlimii*) G.H.
P. × *Sedenii candidulum* (*longifolium* × *Schlimii*) G.H.
P. × *Sedenii leucorrhodum* (*longifolium Hartwegii* × *Schlimii albiflorum*) G.H.
P. × *Sedenii porphyreum* (*longifolium Hartwegii* × *Schlimii albiflorum*) G.H.
P. × *Sedenii superbum* (*longifolium* × *Schlimii*) G.H.
P. × *Umbriel* (*grande* × *Sargentianum*) G.H.

NOTES

The St. Louis Florists' Club held a meeting at the Garden, November 21.

Sergeant A. B. McIntyre, of the Aviation Corps, formerly outside foreman at the Garden, visited the Garden recently.

Dr. W. W. Bonns, formerly Rufus J. Lackland Fellow, has accepted a position as director of the botanical research department of Eli Lilly Co., pharmaceutical chemists, Indianapolis.

Mr. Alexander Lurie, Horticulturist to the Garden, has been appointed Assistant to the Director of the Production Division of the Federal Food Administration of St. Louis.

Dr. B. M. Duggar, Physiologist to the Garden, has been appointed a member of a Committee on Standardization of Terminology and Methods in Phytopathology, which will hold its first session in Baltimore, December 27.

On the afternoon of November 20, the British Educational Commission to the United States visited the Garden. Members of the party were: Dr. A. E. Shipley, University of Cambridge; Sir Henry Miers, University of Manchester; Rev. E. M. Walker, Oxford University; Sir Henry Jones, University of Glasgow; and Dr. John Joly, Trinity College, Dublin. Much interest was manifested in the library, herbarium, and laboratory equipment for graduate work in botany, as well as in the various collections of plants in the greenhouses.

In exchange for a duplicate collection of vandas and nepenthes, Mr. Joseph Manda, of West Orange, New Jersey, orchid expert of the eastern states, has contributed to the Garden a valuable collection of brassocattleyas, cattleyas, and laeliocattleyas. These plants are recent hybrids from rare types which will add greatly to the orchid displays. Among them the albino variety of *Laeliocattleya Canhamiana* and the brassocattleyas, noteworthy for their extremely large, fringed lips, stand out most prominently. The entire collection includes the following:

Brassocattleya × *Ilene* (*B. C.* × *Maronae* ♀ × *C. Dowiana*)
Brassocattleya × *Leemanniae* (*B. Digbyana* ♀ × *C. Dowiana*)
Brassocattleya × *Mariae* (*B. Digbyana* ♀ × *C. Warneri*)
Brassocattleya × *Maroni* (*B. Digbyana* × *C. Mendelii* ♀)
Brassocattleya × *Thorntonii* (*B. Digbyana* × *C. Gaskelliana* ♀)
Brassocattleya × *Wellesleyae* (*B. Digbyana* ♀ × *C. Lueddemanniana*)
Cattleya × *Adula* (*bicolor* × *Hardyana*)
Cattleya × *amabilis* (*labiata* ♀ × *Warscewiczii*)
Cattleya × *Beatrice* (*Dowiana* ♀ × *Minucia*)
Cattleya × *Brenda* (× *Dusseldorffei Undine* ♀ × *Gaskelliana alba*)

Cattleya × *Dusseldorffei* (*intermedia* ♀ × *Mossiae*)
Cattleya × *Fabiata* (× *Fabia* × *Portia*)
Cattleya × *Harold* (*Gaskelliana* ♀ × *Warscewiczii*)
Cattleya × *Kienastiana* (*Dowiana* ♀ × *Lueddemanniana*)
Cattleya × *Minucia* (*Loddigesii* ♀ × *Warscewiczii*)
Cattleya × *Naidia*?
Cattleya × *Prince John* (*Dowiana rosita* ♀ × *Hardyana*)
Cattleya × *Thurgoodiana* (*Hardyana* ♀ × *Lueddemanniana*)
Laeliocattleya × *Alphand* (*C.* × *Fabia* ♀ × *L. C.* × *callistoglossa*)
Laeliocattleya × *Artoturus*?
Laeliocattleya × *autodoin* (*C.* × *Doinii* ♀ × *L. autumnalis*)
Laeliocattleya × *Ballii* (*C. Schroederae* × *L. cinnabarina* ♀)
Laeliocattleya × *Canhamiana alba* (*C. Mossiae* × *L. purpurata* ♀)
Laeliocattleya × *Carmencita* (*C. Dowiana* ♀ × *L. C.* × *luminosa*)
Laeliocattleya × *Colemaniana* (*C. Dowiana* ♀ × *L. C.* × *callistoglossa*)
Laeliocattleya × *Cooksonae* (*C. labiata* ♀ × *L. C.* × *Olive*)
Laeliocattleya × *Domos* (*C. Mossiae* ♀ × *L. C.* × *Dominiana*)
Laeliocattleya × *Golden Oriole* (*C. Dowiana* × *L. C.* × *Charlesworthii*)
Laeliocattleya × *Linda*?
Laeliocattleya × *Mita*?
Laeliocattleya × *Olivia* (*C. Schroederae* × *L. Jongheana*)
Laeliocattleya × *Rhenus* (*C. Dowiana* × *L. C.* × *Woodhamii*)

STATISTICAL INFORMATION FOR OCTOBER, 1918

GARDEN ATTENDANCE:

Total number of visitors.....27,308

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts..... 21

PLANT DISTRIBUTION:

Total number of plants distributed in exchange..... 59

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 23
Total number of books and pamphlets donated..... 33

HERBARIUM ACCESSIONS:

By Gift—

B. F. Bush—*Polyporus sulphureus* from Missouri..... 1
J. A. Drushel—Plants of central United States..... 17
Prof. J. H. Faull—*Stereum versiforme* B. & C..... 1
H. C. Irish—*Anthurus borealis* Burt from Junior High School garden 1
Kew Herbarium, by Sir David Prain—Portions of type specimens of *Hymenochaete Cacao* and *H. tenuissima*.. 2
G. H. Pring—Orchids, pitcher plants, and specimens of new hybrid water-lilies..... 6
Dr. F. L. Stevens—Fungi of Porto Rico, including several types 77
J. A. Stevenson—Fungi of Porto Rico and Santo Domingo 8
Dr. S. M. Zeller—Fungi of Michigan and Missouri..... 8

By Exchange—

Botanic Gardens, Sydney, by J. H. Maiden—Plants of Australia 150
Bureau of Science, Manila, by E. D. Merrill—Plants of the Philippine Islands..... 615
Ralph Hoffmann—*Senecio pauperculus* Michx. from Michigan 1
Dr. Earl E. Sherff—Photographs of type specimens, chiefly of *Bidens* and *Xanthium*..... 36

TOTAL..... 923

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.

Missouri Botanical Garden Bulletin

Vol. VI DECEMBER, 1918 No. 10

CONTENTS

	Page
Some Early History of the Garden	127
Additional Information Relative to the Works of Art Contributed by Henry Shaw	134
Savory Herbs	138
Statistical Information for November, 1918	141
Index to Illustrations of Volume VI	143
General Index to Volume VI	145

ST. LOUIS, MO.
1918
Published Monthly Except July and August by the Board of Trustees

SUBSCRIPTION PRICE:
ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL, AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING.

President,
EDWARDS WHITAKER.

Vice-President,
DAVID S. H. SMITH.

EDWARD C. ELIOT.

GEORGE C. HITCHCOCK.

P. CHOUTEAU MAFFITT.

EDWARD MALLINCKRODT.

LEONARD MATTHEWS.

WILLIAM H. H. PETTUS.

PHILIP C. SCANLAN.

JOHN F. SHEPLEY.

EX-OFFICIO MEMBERS

FREDERIC A. HALL
Chancellor of Washington University.

HENRY W. KIEL,
Mayor of the City of St. Louis.

GEORGE T. MOORE,
President of The Academy of Science of St. Louis.

HENRY L. WOLFNER,
President of the Board of Education of St. Louis.

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.

CHARLES A. ROE, Secretary

Missouri Botanical Garden Bulletin

Vol. VI St. Louis, Mo., December, 1918 No. 10

SOME EARLY HISTORY OF THE GARDEN

In looking up data regarding some of the collections in the herbarium, some interesting facts concerning the early history of the Garden were discovered, of which it seems worth while making a permanent record.

Mr. Shaw was an omnivorous reader and spent a great deal of time hunting for information about the plants growing in the Garden. Much of this is in scattered notes, and these notes were later gathered together in two manuscripts, one called "Guide to the Missouri Botanical Gardens" and the other "A guide to the trees and shrubs in the arboretum of the Missouri Botanical Gardens." The latter paper was unfinished. In it a short description of the land now occupied by the Garden is given as follows:

> **"When the writer first visited these grounds in 1820, they were called 'La Prairie de la Barrière à Denoyer' from Louis Denoyer who formerly lived at, and kept, the gate of the fence (barrière), by which the commons of the old village of St. Louis were surrounded. For a distance of nearly two miles from where Tower Grove Park is now laid out to Taylorwich Station, or rather the pond still existing there [1875], no trees were growing except two or three venerable cottonwoods (*Populus canadensis*) in the low ground, on the watercourse running to Rock Spring and thence to Chouteau's Millpond; on this small watercourse were a few plants of the *Nymphea odorata* Ait., sweet-scented water lily, and a clump of hazel bushes on the rising ground, where the grove at the Garden now exists. The prairie was grown over with a tall natural grass, Andropogon, prairie grass, with an occasional patch of the wild strawberry (*Fragaria Virginiana*), of which neither a tuft of the grass nor a plant of the strawberry can now be found. There were no residences in sight nor any to be seen on the narrow road passing Rock Spring to St. Louis till coming to the stone dwelling of Mr. John B. C. Lucas, on the street now called 7th Street, and the house and garden of Mr. Joseph Charles Sen, now 5th and Market Streets, where he was the first to cultivate the grape vine (Isabella) at St. Louis, and a zealous planter and protector of shade trees."**

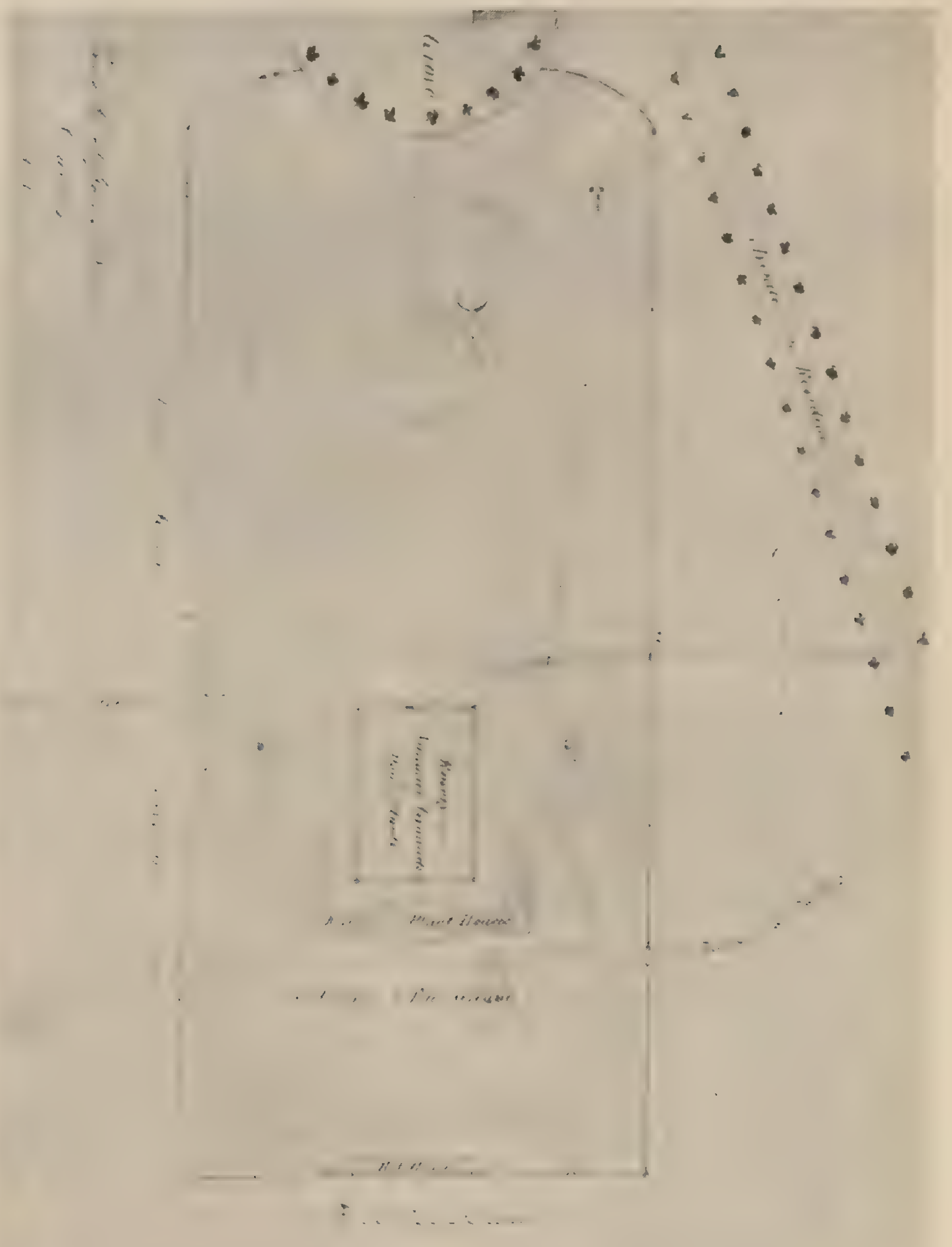
In the "Guide to the Missouri Botanical Gardens" a fuller history of this land is given. Mr. Shaw acquired the prop-

erty by purchase from Thomas Jefferson Payne, in 1840. Payne had laid out a race track, the center of which was in a grove of trees. Near the grove Mr. Shaw built his house with a tower and called it Tower Grove. This was his country home and became his favorite spot. Like all Englishmen of wealth, he believed in having a town house as well as a country house, so the town house was built on Seventh and Locust Streets, in 1851, two years after the completion of Tower Grove.

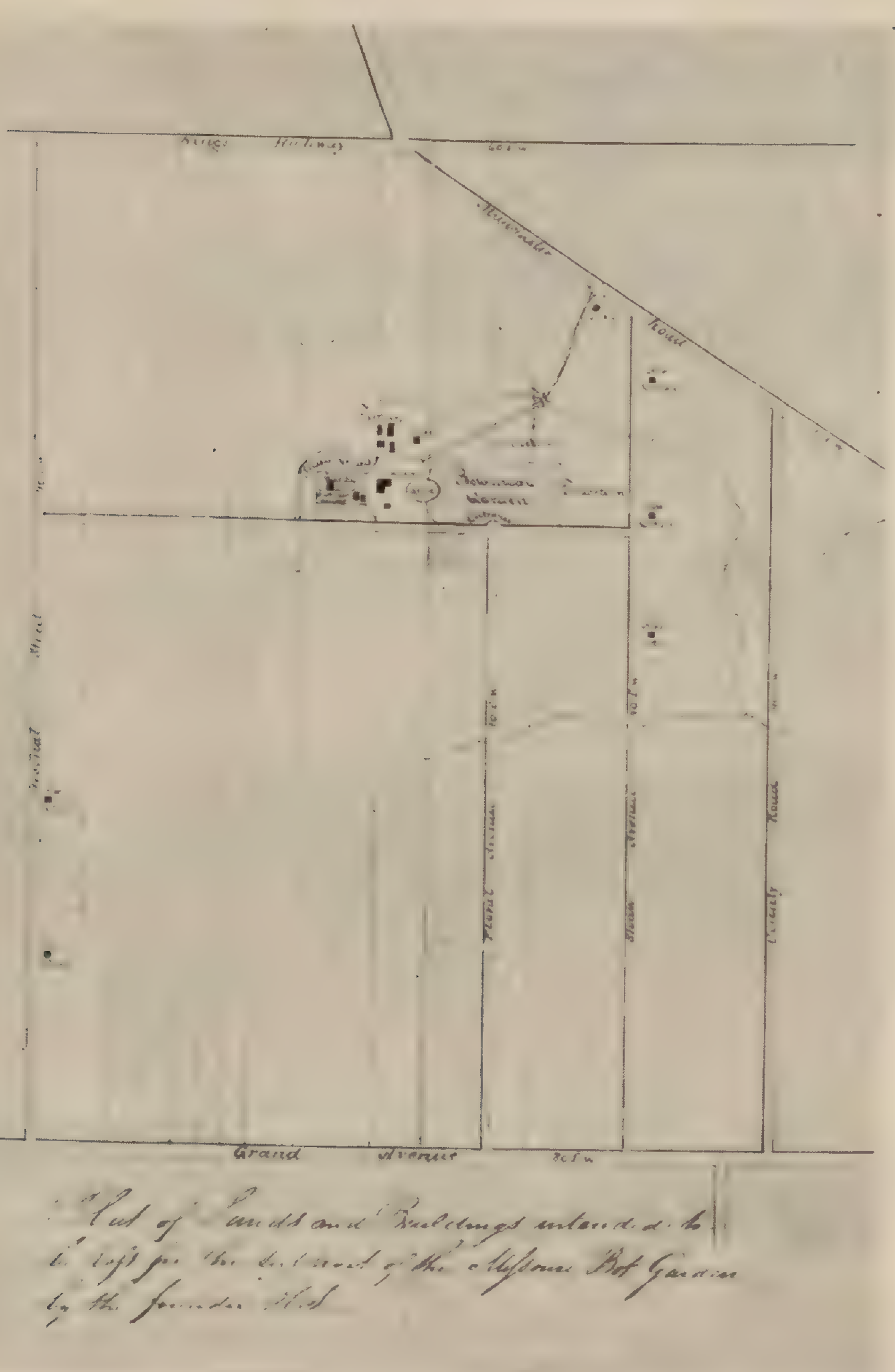
Shortly after purchasing this property, Mr. Shaw went to Europe, and most of his time during the next ten years was spent in visiting different places of interest on the Continent, Constantinople and Egypt. The idea of establishing a garden came to him during this time. Among interesting papers left by him is a sheet entitled "List of places worthy of notice," in which is given a list of thirteen places, with addresses and directions as to how to reach them, in Mr. Shaw's own handwriting. The thirteen places are all gardens or nurseries. Mr. Thomas Dimmock, in a biographical sketch of Mr. Shaw,[1] says that Mr. Shaw told him that "it was while walking through the grounds at Chatsworth—the most magnificent private residence in Europe—that the fruitful idea first dawned upon him. He said to himself: 'Why may I not have a garden, too? I have enough land and money for something of the same sort in a smaller way.'" In the "Guide to the Missouri Botanical Gardens" Mr. Shaw says that the idea of starting the Garden came "during his travels in Europe from 1840 to 1850." Observing the great attention paid to public parks and gardens in England, France, and Germany and the high esteem in which these institutions were held by the people of those countries, he conceived the idea of founding a Missouri Botanical Garden, for which the grounds, ample in extent and in close vicinity to the future great city of the west, were so appropriate. The plan of the Garden was determined on, drains constructed, and the wall surrounding the same commenced in 1855.

Dr. George Engelmann, one of the foremost botanists in America, resided in St. Louis, and Mr. Shaw went to him with his hopes and his plans. Dr. Engelmann was studying cacti and various other groups of plants and had started a small garden near his home. He encouraged Mr. Shaw in every way possible, selected botanical books for him to study and gave him his first introduction to scientific botany. When Dr. Engelmann went to Europe in 1856 he was commissioned by Mr. Shaw to buy books and other things

[1] Mo. Bot. Gard. Rept., vol. 1, p. 12, 1890.



PLAN OF GARDEN PREPARED BY MR. SHAW, IN 1858.


Grand Avenue
Road
Road
Road

needed for the Garden. In a letter[1] dated October 18, 1856, he wrote to Dr. Engelmann, then at Kew, saying, "Get all the plans and catalogues you conveniently can. My mind is intent on the undertaking which I am anxious to commence, and by dint of reading and observations am endeavoring to gather up some crumbs of botanical science." Apparently his first idea had been to get only such as he needed himself, for in this same letter he states, "Hope you will not give yourself much trouble in the seeking of these works, as you might probably find some others equally or more suitable to my object—that is, to acquire a knowledge of botany and horticulture myself and diffuse a taste for the same among others. In the purchase of books, you can go to the amount of one hundred dollars."

Dr. Engelmann was then at the Kew Gardens and he interested Sir William J. Hooker, the Director, in Mr. Shaw's Garden. On August 10, 1857, Sir William Hooker wrote to Mr. Shaw[2] that "very few appendages to a garden of this kind are of more importance for instruction than a library and an economic museum, and these gradually increase like a rolling snow-ball." This letter and Dr. Engelmann's influence seem to have decided Mr. Shaw to start a botanical library and museum. In a letter to Dr. Engelmann,[1] dated September 15, 1857, he says, "As to the botanical library, if you will have the goodness to send me a list of such works as you consider the most essential, I will select from them what may appear to me most useful for the present. As to the herbarium you mention of Prof. Bernhardi, if it is in good order you can purchase the same at the price you mention ($600)."

The Bernhardi herbarium was bought three months later and at a lesser figure, as is shown by the following receipt:

"Leipzig, Saxony, Dec. 18, 1857.

"Mr. Henry Shaw at St. Louis
"to Theodor Bernhardi agent.
"to the Herbarium or collection of Plants of the late Prof. Joh. Jac. Bernhardi of Erfurt, consisting of 374 packages (said to contain about 40,000 species) of dried plants.
"Prix dollars 400.

"Recd. Pay't. by Dr. George Engelmann.

"Theodor Bernhardi."

The letter from Dr. Engelmann to Mr. Shaw telling about the herbarium cannot be found, but apparently the collection was not fully labeled, as he writes,[1] on January

---

[1] Engelmann letters, vol. S, in Mo. Bot. Gard.
[2] Mo. Bot. Gard. Rept., vol. 1, p. 13. 1890.

13, 1858, "if possible, my dear Sir, by all means get the deficient labels to them; perhaps the cost would be considerable, but then what an advantage to have them complete. I should not regret the expense—it could not be done probably in St. Louis except by yourself and then you will be otherwise occupied. The list of books has my best attention. . . . I have all Loudon's works except his Gardeners' Magazines 1st and 2nd series which I should very much like to have. They contain valuable information to persons like myself devoted to horticulture and planting."

The next letter,[1] dated May 18, 1858, refers again to the Bernhardi herbarium: "I submit with due deference to the opinion of yourself and learned friends as to labeling the plants of the Bernhardi herbarium. . . . Am now vigorously at work on the building of the Hort. Bot. Missouriensis."

The details of the Garden, planting, etc., occupied most of Mr. Shaw's time. In the letter quoted from previously, September 15, 1857, he speaks of the early work done in the Garden:

> "Some of the seeds you sent me from Berlin came up and flowered: most of them were annuals; more seeds of perennial trees and hardy shrubs would be acceptable. The garden is all trenched over 2 ft. deep (cost $1,000) and is in fine order for planting anything—two large tanks, 10,000 gals.—two wells with a main drain arched with stone and large and deep. The drains and tanks cost $2,000.00. Am now building the walls of stone and brick; two sides will be finished in 60 days at a cost of $6,000. The west or entrance side, I intend to build next year and also the plant houses, so that you see I am by no means idle. If I attempt too much at once, I should make a fatigue of a pleasure. The museum and library must be built after the plant houses—say in 1859. I intend to have everything substantial and elegant but on a small scale. I shall commence the ornamental planting next spring, the botanical arrangements afterwards. All this I am doing according to my own ideas gathered from horticultural works of Loudon, McIntosh, etc.—no one here can give me the least information. How can I obtain dried specimens of seeds, fruits, and woods of tropical growth as at Kew? A good collection in this way would be among the most interesting and instructive things we could have. . . . I take a great and increasing pleasure in my undertaking and am devoting myself almost entirely to it. I shall have a plan made of the grounds as well as of the whole of my Tower Grove estate and send a copy to Sir Wm. Hooker for his inspection and advice."

In the letter of January 13, 1858, also previously quoted from, he writes more of the work done in the Garden:

> "I am employed every day in my great undertaking—I may say every hour in the day. Good and substantial stone and brick drains are made in every part of the ground. The stone wall on

[1] Engelmann letters, vol. S, in Mo. Bot. Gard.

the west side and the brick wall coped with stone on the north sides are finished at a cost of 8,000 dollars. I am now proceeding with the entrance gate and lodge on the eastern front, which with the stone walls and iron railing I estimate to cost not much short of $10,000—all substantial and elegant. At the same time I shall commence the plant houses (150 feet) against the north wall (one of the compartments I intend for cacti and succulent plants), also the rosarium or sunk parterre, which together with the plant houses will cost about $5,000. These buildings with some planting of trees and shrubs and fencing Tower Grove and Shaw Avenues and building two brick cottages will be my work for the present year, 1858. I enclose you a plan of the garden and the lands intended to endow the same, in amount more than 600 acres. . . . I feel quite competent to the building of plant houses suited to this climate, as regards construction, heating and ventilation, theoretically from books and six years' experience in my private garden. . . . I have sent plans to Prof. Gray and Sir W. Hooker, and with many thanks for your pains and exertions."

Dr. Engelmann returned to St. Louis in 1858 and took an active interest in the Garden until his death. He likewise interested Dr. Asa Gray in the project, and in 1859 Dr. Gray wrote,[1] saying, "Shaw has just written and I have replied expressing a lively interest in his projected establishment and offering my best services if he requires them in the way of advice or suggestion."

The gateway was erected in 1858 from a design of George I. Barnett.[2] The museum and library building was finished in 1860, and the Bernhardi herbarium, the library, and many things collected by Dr. Engelmann[3] in Europe were put in place. The Bernhardi collection consisted of approximately 70,000 specimens. At Dr. Gray's and Dr. Engelmann's suggestion, August Fendler was employed as a sort of curator in the Garden and museum.[4] He began work for Mr. Shaw on October 12, 1860, at $1.00 per day, and worked for him about a year and a half, according to Mr. Shaw's private cash book. His chief work seems to have been the arrangement of the Bernhardi, Riehl, and other collections in the museum.

According to the plans adopted in 1858, the Garden was divided into three large divisions, containing about 60 acres altogether:[2]

"1st, The Garden proper, containing the plant houses for tropical and other plants requiring protection, the herbaceous ground with plants scientifically arranged and named, and the cacti in the north end of the Garden next the wall.

"2nd, The Fruticetum for shrubbery and experimental fruit gardens.

---

[1] Engelmann letters, vol. G, in Mo. Bot. Gard.
[2] MSS. Guide to Missouri Botanical Gardens, by Henry Shaw.
[3] Trans. Acad. Sci. St. Louis, vol. 1, p. 316. 1857.
[4] Letters from Dr. Engelmann to Dr. Parry, Jan. 24, 1861.

"3rd, The Arboretum, containing a collection of trees, comprising all that will grow in the open air in this climate and locality; a Pinetum for the Pine Family, a Quercetum for oaks and a Salicetum for willows."

The arboretum was started in 1860, and this part of the Garden received much personal attention from Mr. Shaw. The trees were mostly planted in rows, and many of them were measured each year to get the rate of growth. Unfortunately, many of them were blown down by a tornado in 1896.

Dr. Engelmann went to Europe again in 1868, and Mr. Shaw writes to him eagerly asking for more plants, seeds and specimens for the museum. In fact, Dr. Engelmann did more for the Garden and museum than anyone else, except Mr. Shaw himself. In 1868, the plants having outgrown the original plant houses, Mr. Shaw writes[1] that a palm house with additional wings for "moist store and temperate house" was built near the center of the Garden. Another letter, written January 24, 1869, tells of more changes:

"Since I addressed you last, I have brought the plant houses to a finish, removing those that stood against the wall and putting them in range with the Palm House. The heating apparatus answers beyond my expectations. . . . The learned Agassiz was here last October and was much pleased with our garden. He promised some leaves and fruits of Amazonian palms for our Museum. The garden was visited by increased numbers the past summer. I think not less than 40 to 50 thousand. I do wish we had something more interesting and instructive for the inspection of such multitudes."

Orchids now began to demand attention, and the Garden collection was started by a gift from Mrs. Henry T. Blow of the orchids collected by her in Brazil. From that time on, orchids have been one of the favorite display plants in the Garden.

In 1882, the plants having again outgrown their quarters, a larger house was built and "dedicated to Linnaeus by placing his bust over the entrance."[2] This is the Linnean House and the only one of the plant houses built by Mr. Shaw that still remains.

The Garden has always been open to visitors and for many years registers were kept, most of which are still in the possession of the Garden. The first one says on the title page:

"Visitors to Tower Grove and the Botanical Garden are respectfully requested to write their names.

"Henry Shaw."

[1] Engelmann letters, vol. S, in Mo. Bot. Gard.
[2] MSS. Guide to Missouri Botanical Gardens, by Henry Shaw.

The first page bears the inscription "Commencing June, 1859," also in Mr. Shaw's handwriting. Several hundred visitors to the Garden registered that year and many more the following year. In 1880, Mr. Shaw wrote:

> "The Gardens have been visited by eminent men of science, among whom Sir Joseph Hooker, Director of Kew Gardens, Prof. Asa Gray, the late Prof. Agassiz, and the celebrated plant collector Roesl, now in South America, and others, who have warmly encouraged the proprietor in his exertions in collecting and bringing forward the plants, shrubs, and trees to their present state of growth. He has had much aid by the contributions and councils of Dr. Geo. Engelmann and the approbation of the citizens of St. Louis and the public in general, who visit the Gardens in increasing numbers. It is computed that a million or more people have seen the Garden since its first opening in 1860."

Dr. Engelmann died in 1885, and Mr. Shaw, wishing to commemorate his memory, called Dr. Asa Gray in consultation, with the result of the founding of the Henry Shaw School of Botany and establishing therein the Engelmann professorship of botany. The very valuable herbarium of Dr. Engelmann and his library were given to the Garden by his son, Dr. George J. Engelmann, and formally accepted by the trustees on October 14, 1889.

Finally, it may be of interest to add a list of the rules which were considered necessary by Mr. Shaw when the Garden was opened:

> "1. Smoking, or eating and drinking or the carrying of provisions of any kind into the Gardens are strictly forbidden. No dogs can be admitted.
>
> "2. No packages or parcels, bags or baskets are allowed to be carried into the grounds. All such must be deposited at the Gate of Entrance, while the owners make the tour of the Gardens.
>
> "3. No person attired otherwise than respectably can enter, nor children too young to take care of themselves, unless a parent or suitable person be with them. The police (when there) have orders to remove such, or also persons guilty of any kind of impropriety. When large schools are admitted, they must be accompanied by a requisite number of Tutors and in accordance with the rules of the Gardens.
>
> "4. It is by no means forbidden to walk upon the grass walks; still it is requested that preference be given to the gravel paths, and especially that the lawn edges parallel to the walks be not made a foot way, as nothing renders them more unsightly. It is scarcely needful to say that all play, leaping over beds, running on the grass and slopes are prohibited. The Gardens are intended for agreeable recreation and instruction, not for idle sports.
>
> "5. It is requested that visitors will refrain from touching the plants and flowers; a contrary practice can only lead to suspicion, perhaps unfounded, that their object is to abstract a plant or flower, which when detected must be followed by expulsion.
>
> "6. In entering the plant houses, it is particularly requested that visitors will keep to the right; if they do otherwise, they

will pass each other, which the narrowness of the walks renders difficult, and this must occasion inconvenience to all parties and often injury to the plants."

ADDITIONAL INFORMATION RELATIVE TO THE WORKS OF ART CONTRIBUTED BY HENRY SHAW

Since the publication of the article in the September, 1918, BULLETIN on "Henry Shaw's Contribution to Art in St. Louis" certain additional letters from the artist Miller have been found which throw further light upon the history of these statues. It is believed that the matter is of sufficient interest to warrant the printing of the letters which follow:

"Munich, November 20th, 1875.

"Dear Sir:

"I herewith send you the sketch of the great poet Shakespeare, but let me again tell you that they are only rough sketches, merely made to give you an approximate idea of what I am willing to make; the same is to be said of the Humboldt sketch, which appears too short on the photograph. My idea was not to represent Shakespeare as an enthusiast or an ideal poet, but as a man of action, who knew mankind. In the right hand I gave him a pen; on the column lays a sheet of paper on which a passage of one of his works could be engraved. The pedestal is in the style of his time, on the front of which we could put the name 'Shakespeare the great poet' and on the three sides reliefs; the corners would be decorated with emblems representing 'tragedy, comedy, etc.' below Acanthus leaves. I repeat that the design could be made so exact that they would have no trouble whatever to execute the stone work in America. The cost of these bronze ornaments on the pedestal would be about 1800 dollars. I would like very much to have the pedestal executed in this way. It would then be a monument where the pedestal corresponds with the figure and stands in perfect harmony.

"Although the Shakespeare statue in New York is very fine, I do not think that the pedestal suits it very well. Should the sum that you have fixed not be sufficient for the bronze decoration on the pedestal, we must, of course, then do without it. I have given you the costs as cheap as possible in the interest of the matter and hope that the reputation of our establishment will give you sufficient guarantee for the very best execution of the work. Hoping that I shall be able to follow all your desires, I am,

"Yours very respectfully,

"F. v. Miller."

"Munich, December 29th, 1876.

"Dear Sir:

"I cannot let the old year pass by without sending you my best wishes for the coming new one.

"Your kind letter of November 18th was very delightful to me, as it gives me the satisfaction that you are contented with every-

thing that I have made. I hope that it will be so for the future and you and everybody will enjoy the two monuments.

"With the Humboldt relief I shall do as you desire and make the volcanoes smoking. It was only a small wax sketch that I sent to you, wherein it is not possible to give the effect as it would be in the large relief. On the other side I shall put palm trees, which, though, must not be out of proportion on account of the other relief.

"If you allow me I shall not send you the sketches of the other reliefs, as this makes me lose so much time waiting for the answer and I believe that you can depend that everything will be all right. I knew that the pedestal would look well and I am very thankful to you that you have followed my advice.

"Shakespeare is in the foundry already. You will receive him first, as I have only commenced modeling Humboldt a short time ago. Lady Macbeth is finished. Falstaff, I am just working at. I am trying to get the portrait likeness of Ben deBar as near as possible, although it is very difficult, as the beard, etc., will always spoil it, but I hope it will be very good.

"I have regretted very much that you did not allow me to place your medallion on the back of the Humboldt monument, but just as you like. Is the front side of the stone as I put it down here polished, that is where the inscription will be fastened to the stone every single letter? I shall send the exact instructions about that later, as well as about the fastening of the bronze reliefs and the statues; iron cannot be employed for it, for iron will rust and the rust would always run down the pedestal.

"Shakespeare will be shipped by the end of May if the casting succeeds, and also the reliefs. Humboldt cannot be completed before late in the autumn. You will be surprised that it takes so long a time, but if I tell you that I model all alone and have nothing done by a stranger, for the purpose of being sure that everything is well done, you may have an idea how hard I worked until now and how much I have yet to do to be able to give you the pleasure of bringing you soon in the possession of the two monuments. With kindest regards

"Yours very truly,

"F. v. Miller."

"Munich, February 20, '77.

"Mr. Henry Shaw, St. Louis:

"Although I did not get any news from you since my last letter, I wish to send you the photograph of the Hamlet relief sketch and would be obliged to you if you give me your opinion on it immediately. Macbeth and the Queen Katherine are mostly finished, and I shall send you the photographs of them in a few days. With Queen Katherine I had great difficulties to find an appropriate scene for the small space and so I chose the moment when she leaves the throne supported by her Patience. I think it will please you.

"The relief of the Chimborazo and a palm landscape are also almost finished. You will receive from me a paper cut in some days, showing the size of the Shakespeare relief and one for Humboldt; it is the exact size of the bronze reliefs and will you be so kind as to hold these papers to the stone, but into every frame and you will then see if everything fits. The measure of the Shakespeare plinth is also inclosed in the package. Please to

place the same on the top of the plinth and let me know immediately if all is right, so that if there is anything to alter it can still be done here.

"I would like to know the exact depth of the space where the reliefs are to be set; it must be at least two centimetres commencing with the frame.

"With many kind regards and hoping to hear from you, I am,

"Yours very respectfully,

"F. v. Miller."

"Munich, November 2, 1877.

"Dear Sir:

"The day before yesterday I have sent you my last letter and today I receive yours of October 14th; you may imagine how astonished I was. Your wishes cannot be satisfied any more. The reliefs of Humboldt are entirely completed; some parts of the statue itself are already cast, the others are being molded. The cost to the entire completion may yet be 2000 dollars; if it is not going to be completed 4500 dollars will be lost, because almost nothing of the work can be used. The model is cut in pieces and lays in the mold; the mold is worthless if nothing is to be cast into it.

"I cannot agree with your last opinion, that Humboldt should, through the progress of science, be put in the background. I rather find the inscription that you want to have engraved on the monument, which says, 'In honor of the most accomplished traveller of this or any other age' very correct and I am sure that this will be true for all times. Humboldt will for science always remain the second discoverer of America. And how little they think in our country that Humboldt should be less esteemed in the future is shown by the fact that in Berlin a monument is going to be erected for the great discoverer for the price of 'one hundred thousand marks.'

"I must confess that if you had asked me before Humboldt was finished if Columbus or Humboldt, I also would have pleaded for Columbus. He is the man who has discovered America, and is therefore more popular for the great mass. But Humboldt's merits are only known by the learned men and his theories are the foundation for a new science. Just imagine how disagreeable it would be for me if Humboldt almost finished would not be erected. Even if no material damage would result for me, how happy is the artist whose work finds the general admiration and satisfaction. No one would believe the real cause, the more as the generous idea of a noble American citizen is known to a large extent and the work itself generally admired.

"My proposition would therefore be if you will in no case erect the Humboldt as a pendant for Shakespeare to put the same in your Missouri Botanical Garden or in any other place, or else even, this would be very sad to me, sell it to any other city or museum. I believe that the sum for the monument without the pedestal is so small that you would have no difficulty in selling a work of art like this; for without praising myself I can say that it is a success in every respect. I shall then make a Columbus for you for the same amount of money that I asked for late Humboldt. The best would, of course, be to put Humboldt on his old place in the park and you have a Columbus made for some other place, but larger than these two statues are, for Columbus has a great

meaning for America. If you make a present of the figure and the city or somebody else of the pedestal your idea could easily be carried out. I am sure that there are plenty of fine places left for Columbus in Tower Grove Park.

"To my great sorrow I heard that Ben deBar is dead. I had wished that he could have seen my works, for he had a very correct judgment. It is possible that you found his likeness not very resemblant. It is rather difficult to strike any one's likeness in a strange costume and after a photograph, but you will find that the relief is more resemblant than the photograph that I have sent to you. I hope you will be satisfied with the portrait medallion of yourself. At least I think that it is very much like you.

"Please let me soon have news from you and deliver me from the anxiety in which your last letter has put me. With many kind regards, I remain dear Sir,

"Yours respectfully,

"F. v. Miller."

"Munich, January 2, 1878.

"Dear Sir:

"Many thanks for your kind letter; it delivered me from the painful uncertainty whether I had worked a whole year for nothing or not, for it is a loss in an artist's life to destroy a successful piece of work.

"But, that it is impossible to change a statue that must have the portrait likeness not only in face but also in the whole countenance into an entirely other one, will be comprehensible even to a layman. On the other hand, I was very sorry not to be able to fulfil your wish; you mention Rafael's Ascension as an example how the artist should be able to content all wishes, but this is quite different from our case, for there it was the problem to compose an entirely new work.

"To prove this I send you herewith a photograph of the colossal plaster model of Humboldt and the photograph of Columbus as Mr. Probasco of Cincinnati had him painted by the celebrated painter and director of our Academie of fine arts, Mr. Piloty, and you will find that I am right. I don't mean that I find faults in the conception of Columbus by Piloty, but in comparing the two you will find that I would have had to destroy the Humboldt statue before making a new work.

"I would, of course, be very happy to execute the Columbus statue, for it would be an excellent problem to reproduce so grand a figure in the picturesque costume and I would be satisfied to fix the terms of payment at your convenience as far as my means go; send me only one word and I shall remit you sketches, which surely will find your contentment. The Shakespeare statue will probably be in your possession by this time; if you, as I hope, are pleased with it and everything is in good condition, I would be quite thankful to you if I could get the agreed sum for it; I had so many expenses for the bronze cast, and the want of money in our country is yet greater than in America. The relief of Hamlet has been packed today and sent off by rail.

"The insurance is made for only 5000 dollars, because if any accident should happen, I am yet in possession of the plaster model and could execute the whole with reliefs again for the above sum.

My expense for the insurance is: *130 Marks 25 Pfenige.* With many kind regards and my best wishes for the new year, I am as ever,

"Yours very respectfully,

"F. v. Miller."

"B. P. The Shakespeare statue has been shipped on deck from Hamburg to Havre, and it may be that the figure has received green spots by the sea water. Such spots can easily be removed with pulverized red tartar or else with pulverized pumice stone in water. Please let me know if the front of the Humboldt pedestal is polished; if not I shall put the name on a bronze plate."

"Munich, April 30, '83.

"Dear Mr. Shaw,

"Today I have posted a small sketch of the pedestal of Columbus; I have drawn Columbus upon it at the same time, but only very hastily. Jointly I send you a larger drawing of the pedestal to enable you to inquire about the expense. The relievo follows. I am working at the sketch of your grave monument at present and in order to give you an approximative illustration about the appearance of the ensemble, I shall have it photographed. The photograph of the pedestal is also from a sketch which I have made already.

"Expecting a speedy answer and hoping you to be in good health, I am with best regards,

"Yours respectfully,

"F. v. Miller."

"Munich, Erzgiesserei, May 19, 1883.

"Dear Sir:

"Your favour of 26th past and also the drawing came to hand. The bust of Beethoven is already commenced. I would, however, request you to let me know whether the pedestals are round and whether the base on which the bust will get placed is round or angular according to the enclosed drawing, as the foot of the bust is to be made to conform to it. Should the pedestal not yet be made I would take the liberty to send you a drawing with some variations on the pedestal which I think desirable, at least on the upper consoles. The photograph I am expecting.

"With kindest regards I remain, dear Sir,

"Yours very faithfully,

"F. v. Miller."

SAVORY HERBS

Savory, or culinary, herbs are aromatic plants used to add flavor to various cooked products. Most of them are readily grown and should more frequently find a place in small gardens than they do at present. Not only does their aroma add to the palatability and variety of the ordinary diet, but certain condimental properties aid in digestion. Plants, like rue, stimulate the appetite and thus form a part of beverages which are used as appetizers. Others, like pars-

ley, are used merely for garnishing, while various oils employed in perfumery are yielded by a number of herbs.

The following table indicates the herbs grown last summer in the economic garden, with their uses and methods of propagation:

COMMON NAME	BOTANICAL NAME	USE	PROPAGATION
Angelica	*Archangelica officinalis*	Stem and leaves as salad; seeds for flavoring	Seeds during late summer
Anise	*Pimpinella Anisum*	Leaves as garnish; seeds and oil for flavoring and perfumes	Seeds in early spring
Balm	*Melissa officinalis*	Foliage for flavoring and salad; oil for perfumery and beverages	Division, cuttings, seeds
Basil	*Ocimum Basilicum*	High seasoning; oil for perfumery	Seeds in spring
Borage	*Borago officinalis*	Foliage as salad, garnish, or flavoring	Seeds in spring
Caraway	*Carum Carvi*	Herbage as salad; roots as vegetables; seeds as flavoring; oil for perfumery	Seeds in spring
Catnip	*Nepeta Cataria*	Condiment	Seeds in spring
Chervil	*Anthriscus Cerefolium*	Leaves for seasoning	Seeds
Chives	*Allium Schoenoprasum*	Flavoring	Bulbs or division
Clary	*Salvia Sclaria*	In making wines	Seeds
Coriander	*Coriandrum sativum*	Seed in confections, condiments, beverage flavoring	Seeds
Cumin	*Cuminum odorum*	Flavoring in pickle, pastry, soup	Seeds
Dill	*Anethum graveolens*	Seeds as seasoning for pickle; oil for perfumery; vinegar as condiment	Seeds
Fennel	*Foeniculum vulgare*	Herbage for garnishing and flavoring; seeds in beverages and confectionery; oil for perfumery	Seeds
Horehound	*Marrubium vulgare*	Confectionery	Seeds
Hyssop	*Hyssopus officinalis*	Salad; oil in preparation of soap	Division, cuttings, seeds
Lavender	*Lavandula angustifolia*	Flowers and oil in perfumery; condiment	Division or cuttings
Marigold	*Calendula officinalis*	Flowers as seasoning, butter coloring	Seeds
Marjoram	*Origanum vulgare*	Seasoning; oil in perfumery	Division or cuttings
Mint	*Mentha spicata*	Seasoning	Division or cuttings

COMMON NAME	BOTANICAL NAME	USE	PROPAGATION
Parsley	*Petroselinum hortense*	Seasoning, garnish	Seeds
Penny-royal	*Mentha Pulegium*	Seasoning	Division
Pepper-mint	*Mentha piperita*	Flavoring, perfume in soap	Division
Rose-mary	*Rosmarinus officinalis*	Seasoning; oil in perfumery	Cuttings or seeds
Rue	*Ruta graveolens*	Seasoning, flavor in beverages; oil in perfumery	Division, cuttings, seeds
Sage	*Salvia officinalis*	Seasoning; oil in perfumery	Division, cuttings, seeds
Savory, summer	*Satureia montana*	Seasoning	Seeds
Savory, winter	*Satureia montata*	Seasoning	Division, cuttings, seeds
Tansy	*Tanacetum vulgare*	Seasoning	Division, cuttings, seeds
Tarragon	*Artemisia Dracunculus*	Seasoning, salads, decoction in vinegar; oil in perfumery	Division, cuttings, seeds
Thyme	*Thymus vulgaris*	Seasoning; oil in perfumery; oil crystals as disinfectants	Division, cuttings, seeds

STATISTICAL INFORMATION FOR NOVEMBER, 1918

GARDEN ATTENDANCE:

Total number of visitors	14,204

PLANT ACCESSIONS:

Total number of plants and seeds received as gifts	6
Total number of plants received in exchange	32

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	57
Total number of seed packets distributed in exchange	1

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	13
Total number of books and pamphlets donated	5

HERBARIUM ACCESSIONS:

By Purchase —

Canton Christian College—Plants of China	116
A. D. E. Elmer—Plants of the Philippine Islands	2,146

By Gift —

Walter H. Aiken — *Leucophyllum texanum* Benth. from Texas	1
J. A. Drushel—Plants of the central and western United States	26
Dr. W. G. Farlow—Fungi of Massachusetts and New Hampshire	29
Prof. A. Yasuda—Thelephoraceae of Japan	35

By Exchange—

Arnold Arboretum — Plants of Alaska, collected by Miss Alice Eastwood	218
L. Rodway—*Isoetes* from Tasmania	3
U. S. National Museum—Photographs of type specimens in the Herbarium of the University of Oregon	7
TOTAL	2,581

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

Index to Illustrations

	Page
Paeonia officinalis	19
Paeonia arietina	20
Paeonia anomala	21
Cinchona officinalis	24
Garden in floral display house, view of	29
Garden in floral display house, plan of	30
Economic garden, the	41
Cattleya Dusseldorfei var. *Undine*	59
Brown, Mr. D. S., in his orchid house at Kirkwood	60
Livistona chinensis, moving a specimen of, to Garden	61
Chewing gum tree, the	73
Dasylirion serratifolium	74
Pothos celatocaulis	74
Dracaena Kindtiana	75
Dracaena glomerata	76
Bird of paradise plant	76
Banyan tree, the	77
Henry Shaw, tomb of, in the Garden	81
Shakespeare, statue of, in Tower Grove Park	82
Humboldt, statue of, in Tower Grove Park	83
Columbus, relievo on statue of	84
Columbus, statue of, in Tower Grove Park	84
Linnean House—showing the busts of Linnaeus, Nuttall, and Gray	85
Juno, statue of, in the Garden	88
Victory, statue of, in the Garden	89
Nymphaea "General Pershing"	91
Nymphaea "Mrs. Woodrow Wilson" var. gigantea	93
"Electrifier" used at the Garden	97
Comparison of average plant from check plot with one from "electrified" plot	98
Tree improperly pruned and same tree properly pruned	107
Plan of Garden prepared by Mr. Shaw in 1858	130
Plat of lands and buildings intended to be left for the support of the Missouri Botanical Garden	131

General Index

Figures in italics refer to page numbers of plates and cuts.

A.

Achras Sapota, 73
Amaryllis, 30
Amaryllis Belladonna, 31; *formosissima*, 30
Annual bequests, 6
Annual reports for 1917: of the Officers of the Board, 1; of the Director (twenty-ninth annual report), 3
Anthuriums, 61
Araucaria Cookii, 60; *Cunninghamii*, 60; *excelsa* var. *Goldieana*, 60, var. *Muelleri*, 60; *Rulei*, 60
Arborvitaes, winter injury to, at Garden, 70
Art, Henry Shaw's contribution to, in St. Louis, 81; additional information relative to, 134
Astilbe, 37; culture of, 37
Astilbe japonica, 37
Attendance, Garden, for 1917, 5
Australian salt bush, 42

B.

Back-yard gardens, four model, in economic garden, 47
Banyan tree, the, 76, 77
Barberry, Japanese, see *Berberis Thunbergii*
Bartholomew, E. "North American Uredinales," Cents. XVIII and XIX, 28
Bee plants grown in economic garden, 45
Beethoven, bust of, in Tower Grove Park, 89; letters from Miller to Henry Shaw concerning, 85, 138
Beggarweed, 42
Berberis Thunbergii, 69
Bernhardi herbarium, purchase of, 129
Betula alba, 70
Birch, white, see *Betula alba*
Bird of paradise plant, 74, *76*
Bismarckia nobilis, 59
Blackberries, pruning of, 112
Botrytis paeoniae, 24
Brandegee, T. S. Plants of Mexico, collected by C. A. Purpus, 80
Brassavola Digbyana, 59
Brassocattleya Veitchii var. "Queen Alexandra," 59
Brassocattleyas, list of, exchanged for Garden material, 124
Brassolaelia, 59
Broussonetia papyrifera, 70
Brown, Mr. D. S.: gift of plants by, 59; additional gift of orchids by, 113; in his orchid house at Kirkwood, *60*
Bulb show, the indoor, 29; arrangement of, 29; flowers in, 29; plan of, *30*; view of, *29*
Burke, Dr. R. P. Fungi of Montgomery Co., Alabama, 17
Bush, B. F. Plants of Missouri, 58

C.

Canton Christian College. Plants of China, 72; Plants of southern China, 17
Caryota urens, 60
Cattleya Dusseldorfei var. *Undine*, 59, *59*; *intermedia* var. *alba*, 59; *Mossiae* var. *Wageneri*, 59; *Skinneri* var. *alba*, 59
Cattleyas, list of, exchanged for Garden material, 124
Chewing gum tree, the, 73, *73*
Churchill, Hon. Joseph Richmond. Plants of Massachusetts, 80
Cinchona officinalis, 25, *25*
Clemens, Mrs. Joseph. Plants of Oklahoma, 39
Columbus, statue of, in Tower Grove Park, 83, *84*, 87; letters from Miller to Shaw concerning, 83, 136, 137
Corn, Mandan, 41
Cornus, pruning of, 110
Currants, pruning of, 112
Cut-flower border in economic garden, 53
Cyathea dealbata, 60; *medullaris*, 60
Cycads, gift of, by Mr. D. S. Brown, 60

Cycas Bellefonti, 60; *Micholitzii*, 60; *revoluta*, 60; *siamensis*, 60
Cypripediums, see Paphiopedilums

D.

Dasheen, 43
Dasylirion serratifolium, 74, *74*
Davis, Rev. John. Ferns, chiefly from United States, 28; Plants of California, 58; Plants of Missouri, South Carolina, etc., 96; Plants of South Carolina, 58
Dendrobium virginale, 59
Dewberries, pruning of, 112
Dicksonia antarctica, 60; *Chamissoi*, 60; *regalis*, 60; *squarrosa*, 60; *Wendlandi* var. *Verschaffeltii*, 60
Dracaena glomerata, 75; *Goldieana*, 75; *Kindtiana*, 75, *75*

E.

Economic garden, the, 41, *41*, 139
Electricity, effect of, on plants, 97; apparatus used in experiments on, *97*, 98; investigations on, at Garden, 98
"Electrified" plot, comparison of average plant from check plot with one from, *98*
"Electrifier," description of, 98; used at the Garden, *97*
Encephalartos Lehmannii, 60
Engelmann, Dr. George, assistance given to Garden by, 128
Evergreens, winter injury to, at Garden, 70

F.

Farm crops grown in economic garden, 41
Ficus benghalensis, 76, 77
Fischer, Walter. Plants of Argentina, 80
Fruit trees: pruning of, 112; trained, grown in economic garden, 52
Fruits, bush, pruning of, 112

G.

Garden: some early history of the, 127; plan of, prepared by Mr. Shaw in 1858, *130*; plat of lands and buildings left for support of, *131*
Gardening, school for, report of, for 1917, 6
Gates, F. C. Plants of Illinois, 28; Plants of northern Michigan, 28
Gift of plants by Mr. D. S. Brown, 59, 113
Gooseberries, pruning of, 112
Gounod, bust of, in Tower Grove Park, 89
Grapes, pruning of, 113
Grasses, lawn, grown in economic garden, 46, 47
Gray: bust of, at Garden, 87; assistance given by, in founding Garden, 131
Greenman, Milton T. Plants from Door County, Wisconsin, 106

H.

Hedges: plants grown for, in economic garden, 48; pruning of, 110
Heller, A. A. Plants of California, 72
Hemlocks, winter injury to, at Garden, 70
Herbarium, report of, for 1917, 12; distribution of duplicates, 14; field work during 1917, 13; mounting and distribution of specimens, 13; new accessions, 12; statistical summary, 15
Herbs, savory, grown in economic garden, 45, 138; uses, and methods of propagation of, 139
Hippeastrum, 29, 30; culture of, 32; development of, 31; insect pests attacking, 32; propagation of, 32
Hippeastrum "Apple Blossom," 30; *aulicum*, 31; *equestre*, 31; *Johnsonii*, 31; *Leopoldii*, 31; *pardinum*, 30; *psittacinum*, 31; *Reginae*, 31; *reticulatum*, 31; *solandriflorum*, 31; *vittatum*, 31; "White Lady," 30
Humboldt, statue of, in Tower Grove Park, 82, *83*; letters from Miller to Henry Shaw concerning, 135, 136
Hyacinth, 35; forcing of, 36; propagation of, 36; types of, 36
Hyacinthus orientalis, 36, var. *albus*, 36
Hybrid nymphaeas, 90

I.

Improvements at Garden during 1917, 3
Iris, 54; collection of, at Garden, 55; culture of, 55; groups of, 54

Iris flavescens, 54; *florentina*, 54; *germanica*, 54; *hybrida*, 54; *Kaempferi*, 55; *laevigata*, 55; *lurida*, 54; *neglecta*, 54; *pallida*, 54; *plicata*, 54; *sambucina*, 54; *squalens*, 54; *Xephoides*, 55; *Xephium*, 55

J.

Jörgensen, P. Plants of Argentina, 106
Johnson, A. G. Plants of Switzerland collected by Miss Rosa Kuhn, 39
Junipers, winter injury to, at Garden, 70
Juno, statue of, at Garden, 88, *88*

K.

Kentia Brownii, 59
Kerria, pruning of, 110

L.

Laeliocattleya, 59
Laeliocattleyas, list of, exchanged for Garden material, 125
Lectures delivered by members of staff in 1917, 7
Library, report of, for 1917, 15; Garden publications as a means of exchange, 16; loans of books, 16; reclassification of books, 16; statistical, 16; subject index, 16
Ligustrum amurense, 69; *ovalifolium*, 69
Lilium candidum, 33; *Henryi*, 33; *longiflorum*, 33, var. *eximium*, 33, var. *giganteum*, 33; *Reginae*, 31; *speciosum*, 33, var. *album*, 33, var. *Melpomene*, 33, var. *rubrum*, 33
Lily, the, 33; forcing of, 34; history of, 33; species of, 33
Linnaeus, bust of, at Garden, 87
Linnean House, 132; showing the busts of Linnaeus, Nuttall, and Gray, *85*
Livistona chinensis, 60; moving a specimen of, to the Garden, *61*
Lloyd, C. G. Collections of Hymenochaete from various localities, 96

M.

Macoun, John. Fungi of British Columbia, 28
Macrozamia plumosa, 60
Magnolia grandiflora, 70
Medicinal plants grown in economic garden, 48
Miller, Ferdinand, letters of, to Henry Shaw, 83, 134
Mozart, statue of, in Tower Grove Park, 82
Mulberry, paper, see *Broussonetia papyrifera*

N.

Narcissus, 34; culture of, 35; principal species of, 35
Narcissus autumnalis major, 30; *incomparabilis*, 35; *indicus*, 30; *Jonquilla*, 35; *poeticus*, 35; *Pseudo-Narcissus*, 35; *Tazetta*, 35, var. *orientalis*, 35, var. *papyraceus*, 35
Nepenthes, 61
New York Botanical Garden. Thelephoraceae from various localities, 17
Nuttall, bust of, at Garden, 87
Nymphaea castaliiflora, 90, *92;* Daubeniana, 92; "General Pershing," 90, *91*, description of, 91; *micrantha*, 92; "Mrs. Edwards Whitaker," 90; "Mrs. Woodrow Wilson," 92, var. gigantea, 92, *93*, description of, 94
Nymphaeas, hybrid, 90

O.

Orchids: additional gift of, by Mr. D. S. Brown, 113; gift of, by Mrs. Henry T. Blow, 132; list of, excluding Cypripediums and Selenipediums, in Garden collection, 61; list of Paphiopedilums (Cypripediums) and Phragmopedilums (Selenipediums) in Garden collection, 113
Oreodoxa regia, 77

P.

Paeonia albiflora, 19, 21; *anomala*, 21, *21; arietina*, *20*, 21, 22; *Brownii*, 22; *corallina*, 22; *decora*, 22; *Emodii*, 22; *humilis*, 22; *lutea*, 20; *Moutan*, 20, 22; *officinalis*, *19*, 20, 21; *paradoxa*, 21; *peregrina*, 21, 22; *tenuifolia*, 20, 21; *Wittmanniana*, 20, 22
Palm: cabbage, see *Livistona chinensis;* date, see *Phoenix dactylifera;*

fish-tail, see *Caryota urens;* ivory-nut, see *Phytelephas macrocarpa;* sago, see *Cycas revoluta*
Palms: gift of, by Mr. D. S. Brown, 59; growth of, 77
Paphiopedilums, list of, donated by Mr. D. S. Brown, 113
Paulownia tomentosa, 70
Payson, Edwin B. Plants of Colorado, Wyoming, Idaho, and California, 17
Peanut, 42
Peony, the, 19; culture of, 23; fungous disease of, 24; groups of: herbaceous, 20, propagation of, 20, species of, 21; tree, 22, propagation of, 22; varieties of, 25
Perennials, herbaceous, winter protection of, 102
Philodendron pinnatifidum, 74
Phoenix dactylifera, 60
Phragmopedilums, list of, donated by Mr. D. S. Brown, 113
Phytelephas macrocarpa, 60
Pinus montana, 70
Potato varieties, results of tests on, 103
Pothos celatocaulis, 74, *74*
Privet: Amoor, see *Ligustrum amurense;* California, see *Ligustrum ovalifolium*
Protection, winter, of plants, 100; methods of, 101, 102
Pruning, 107; essentials of, 107; of street and lawn trees, 107; of shrubs, roses, and vines, 109; of fruit trees, bush fruits, and grapes, 112
Publications and papers published by the staff and graduate students during 1917, 11

Q.

Quinine, 25; methods of obtaining, 26

R.

Raspberries, pruning of, 112
Research and instruction, report of, for 1917, 7
Rhododendrons, winter protection of, 101
Rosa blanda, 70; *Hugonis,* 69; *multiflora,* 70, 101; *setigera,* 70; *rugosa,* 70, var. *alba,* 70; *Wichuraiana,* 101
Roses: pruning of, 111; winter injury to, at Garden, 69; winter protection of, 101
Rossini, statue of, in Tower Grove Park, 82
Rufus J. Lackland fellowships, appointments to, for 1917-18, 9

S.

Sargent, Dr. C. S. Plants of the Philippine Islands, collected by Aduro and Sabiarya, 80
Selenipediums, see Phragmopedilums
Shakespeare, statue of, in Tower Grove Park, 81, *82;* letters from Miller to Henry Shaw concerning, 134, 135
Shaw, Henry: tomb of, in the Garden, *81,* 88; additional information relative to works of art contributed by, 134
Shaw's, Henry, contribution to art in St. Louis, 81, 134
Shingle plant, see *Pothos celatocaulis*
Shrubs: list of Asiatic, proven hardy at Garden, 71; pruning of, 109; winter protection of, 101; winter injury to, at Garden, 70
Sophrocattleya, 59
Standley, Paul C. Plants of Florida, collected by Miss Jeanette P. Standley, 17
Statistical information for December, 1917, 17; January, 1918, 28; February, 39; March, 58; April, 72; May, 80; June-August, 95; September, 106; October, 126; November, 141
Sternbergia lutea, 30
Strelitzia augusta, 74

T.

Teosinte, 42
Testing of potato varieties, 103
Tree improperly pruned, *107;* same tree properly pruned, *107*
Trees, street and lawn, pruning of, 107; winter protection of, 101
Tulip, 37; propagation of the, 37; types of, 37
Tulipa acuminata, 37; *Gesneriana,* 37, var. *Dracontia,* 37; *retroflexa,* 37; *suaveolens,* 37

U.

Udo, 43

V.

Vegetables grown in economic garden, 43

Verdi, bust of, in Tower Grove Park, 89

Victory, statue of, at Garden, 88, *89*

Vines: grown in economic garden, 50, 51; pruning of, 111

W.

Wagner, bust of, at Tower Grove Park, 89

War, effect of, at the Garden, 77

Winter injury to plants in the Garden, 69

Winter protection of plants, 100

Y.

Yucca filamentosa, 74

STAFF
OF THE MISSOURI BOTANICAL GARDEN

Director.

GEORGE T. MOORE.

BENJAMIN MINGE DUGGAR,
Physiologist in charge of Graduate Laboratory.

EDWARD A. BURT,
Mycologist and Librarian.

HERMANN VON SCHRENK,
Pathologist.

JESSE M. GREENMAN,
Curator of the Herbarium.

KATHERINE H. LEIGH,
Secretary to the Director.

JAMES GURNEY,
Head Gardener, *Emeritus.*

ALEXANDER LURIE,
Horticulturist.

G. H. PRING,
Floriculturist.

J. J. COUGHLIN,
Construction.

W. F. LANGAN,
Engineer.

P. FOERSTER,
Farm and Stables.

H. VALLENTINE,
Carpenter.